MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

Bureau of Land Management
Little Snake Field Office
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ROUTT COUNTY, COLORADO

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Summary and Conclusions

This Mineral Potential Report documents an assessment of the mineral potential of 121 individual parcels of Bureau of Land Management (BLM) -administered public land situated almost entirely within Routt County, Colorado. These parcels constitute the BLM's contribution to a comprehensive, three-way land exchange proposal involving a group of private parties, the State of Colorado and the BLM. Parcels were examined to determine their potential to contain a number of mineral commodities, including coal, oil and gas, geothermal energy, gold, base metals, uranium, fluorspar, and sand and gravel. The occurrence of a mineral resource does not necessarily imply that the mineral can be economically exploited or is likely to be developed in the near future; mineral occurrence potential includes both exploitable and potentially exploitable occurrences.

A number of data sources were used in preparing this report, and the author conducted on-site visits of many of the parcels. Based on the available data concerning a particular exchange parcel, potential was assessed as indicated by the geologic environment, the inferred geologic processes, reported mineral occurrences, valid geochemical and/or geophysical anomalies, and by the presence of known mines or deposits. The assessment of potential was reported in accordance with the Mineral Potential Classification System included in BLM Manual 3031, which provides for a ranking of the level of potential as well as the level of certainty (see Section 7.1).

Table 1 lists the parcels evaluated in this report and summarizes the potential of each to contain specific mineral commodities. An overall ranking of potential and certainty is also presented in the table. Of the 121 parcels examined, 72, or 60

percent, were assessed as having a low potential to contain mineral resources, based generally on indirect evidence. A total of 44, or 36 percent, were considered to have moderate potential to contain minerals, also based on indirect evidence. Only five parcels were found to have high potential for mineral resources, and this assessment was generally based on abundant direct and indirect evidence.

Table 1
Mineral Potential Summary

Parcel #	Mineral Potential – Specific Commodity						Overall Ranking (Potential/ Certainty)
	Leasable Minerals		Locatable Minerals		Mineral Materials		
	Commodity	Potential	Commodity	Potential	Commodity	Potential	
001	Coal	Moderate					M / B
002	Coal	Moderate	Gold	Moderate	Aggregate	Moderate	M / B
003	Coal	Moderate					M / B
004	Coal	Moderate					M / B
005	Coal	Moderate					M / B
006	Coal	Moderate					M / B
008	Coal	Moderate					M / B
009	Coal	Moderate					M / B
011							L / B
012							L / B
013							L / B
014			Gold	Moderate	Aggregate	Moderate	M / C
015							L / B
016							L / B *
017							L / B *
018							L / B *
019							L / B *
020							L / B *
021							L / B
022							L / B
023							L / B
024					Aggregate	Moderate	M / C
025							L / B *
026							L / B *
027							L / B *
028							L / B *
029							L / B
030							L / B
031							L / B *
032							L / B *
033							L / B *
037	Coal	Moderate					M / B
038	Coal	Moderate					M / B
039	Coal	Moderate					M / B
040	Coal Oil & Gas	Moderate Moderate					M / B
041							L / B
042	Coal	Moderate					M / B
043							L / B
044							L / B
045							L / B
046							L / B
047							L / B

Table 1 (Continued)
Mineral Potential Summary

Parcel #	Mineral Potential – Specific Commodity						Overall Ranking (Potential/ Certainty)
	Leasable Minerals		Locatable Minerals		Mineral Materials		
	Commodity	Potential	Commodity	Potential	Commodity	Potential	
048							L / B
049							L / B
050							L / B
051			Gold	Moderate	Aggregate	Moderate	M / B
052							L / B *
054							L / B *
055							L / B *
056	Coal	Moderate					M / B
057	Coal	Moderate					M / B
058	Coal	Moderate					M / B
059	Geothermal	Moderate					M / A
060	Geothermal	Moderate					M / A
061					Meta-Shale	Moderate	M / A
062	Oil & Gas Coal Geothermal	High Moderate Moderate					H / B
063							L / B
064	Coal	Moderate					M / B
065							L / B
066							L / B *
067	Geothermal	Moderate					M / A
068							L / B
069	Coal	Moderate					M / B
070	Geothermal	Moderate					M / A
071							L / B
073	Coal	Moderate					M / B
076	Coal	Moderate					M / B
077	Coal	Moderate					M / B
078							L / B
080	Coal	High					H / C
081	Coal	High					H / D
082	Oil & Gas	Moderate					M / C
084	Coal	High					H / D
085	Coal	Moderate					M / B
087							L / B *
088	Coal Oil & Gas	Moderate Moderate					M / B
089	Coal	Moderate					M / B
090							L / B
091							L / B *
093	Coal	Moderate					M / B
094	Coal	Moderate					M / B
095							L / B
096							L / B
097							L / B
098							L / B
099							L / B
101	Coal	High					H / D
102	Coal	Moderate					M / B
104	Coal	Moderate					M / B
104A							L / B *
104B							L / B *
104C							L / B *
104D	Coal	Moderate					M / B
105							L / B
106					Aggregate	Moderate	M / B

Table 1 (Continued)
Mineral Potential Summary

Parcel #	Mineral Potential – Specific Commodity						Overall Ranking (Potential/ Certainty)
	Leasable Minerals		Locatable Minerals		Mineral Materials		
	Commodity	Potential	Commodity	Potential	Commodity	Potential	
107							L / B
108							L / B
109							L / B
110							L / B
111							L / B
112							L / B
113							L / B
114							L / B
115							L / B *
116	Coal	Moderate					M / B
117							L / B
118							L / B
118A							L / B
119							L / B
120							L / B
121							L / B
121A							L / B
122							L / B
123							L / B
124							L / B
125					Aggregate	Moderate	M / B
126					Aggregate	Moderate	M / B
128							L / B
129					Aggregate	Moderate	M / B
130					Aggregate	Moderate	M / B
131							L / B

Overall Ranking Key:

Potential	Certainty	
L = Low	A = Insufficient data	* = Parcel with low mineral potential and encumbered by oil & gas lease
M = Moderate	B = Indirect evidence	
H = High	C = Direct evidence	
	D = Abundant direct and indirect evidence	

Recommendations

It is unlikely that those parcels having a low potential for mineral resources (see Table 1) will ever be developed into a producing entity. Retaining the mineral rights to these parcels and thereby creating a split estate ownership will make those rights somewhat more difficult for the BLM to manage. A number of parcels deemed to have low potential for oil and gas nonetheless contain valid existing oil and gas leases (see Table 1). Although it is still possible that oil and gas could be discovered on these leases, because of the typically limited extent of the oil and gas fields within the Study Area, they are considered highly speculative, and hence the low ranking. The Federal Government must retain the mineral rights to these parcels and honor the existing leases. For the remainder of those parcels with a low ranking, it is recommended that the underlying mineral rights not be retained by the Federal Government, and that they be conveyed along with the surface to the various private participants in the land exchange.

Parcels having a moderate to high potential for minerals may someday be explored, evaluated, and a few developed into producing entities. For these parcels, it is recommended that the Federal Government retain the underlying minerals.

Three parcels being proposed for exchange, namely 081, 084, and 101, deserve special consideration. All three are considered to have high potential for coal resources, based on abundant direct and indirect evidence. Parcels 081 and 084 are situated wholly or in part within the boundaries of active coal leases COC 081258 and COC 0114093, respectively, and are scheduled to be surface mined in 2007 and 2008. Disposing of the surface at this time could put the mine at a disadvantage in negotiating new surface rental fees, and may also complicate mine reclamation issues. It is therefore recommended that, unless these concerns can be mitigated through the conveyance process, parcels 081 and 084 be excluded from the exchange.

The eastern portion of Parcel 101 partly lies within the boundary of a prior coal lease, COC 037180, now closed. Known surface mineable coal resources exist within this portion of the parcel, and it is quite likely that they will be mined at some point in the future. Although split mineral estate leasing is common throughout the region, according to current coal regulations (43 CFR 3427.1), The BLM cannot lease coal deposits that will be mined by surface methods without the written consent of the qualified surface owner. This requirement can obviously represent a potential risk to the development and mining of Federal coal resources on this parcel and, as such, it is probably not in the public interest to create a situation where this could occur. It is therefore recommended that, unless this concern can be mitigated through the conveyance process, parcel 101 be excluded from the exchange. (Alternatively, as the western half of the parcel is considered to have low to moderate potential for minerals, the boundary of the exchange parcel could be modified to only include the western portion.)

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1. Introduction

This report documents an assessment of the mineral potential of 121 isolated parcels of Bureau of Land Management (BLM) -administered public land situated primarily within Routt County, Colorado. These parcels vary in size from slightly less than five acres to over 1,070, with a total acreage of 15,224. They constitute the BLM's contribution to a comprehensive, three-way land exchange proposal involving a group of private parties, the State of Colorado and the BLM. The original proponent of this exchange was a non-profit, public interest group known as the Emerald Mountain Partnership (EMP). A consulting firm, Western Land Group (WLG) was then endorsed by the EMP to assemble a group of private parties to participate in the exchange. Representing the State's interest in the exchange is the Colorado State Board of Land Commissioners – Northwest District (SLB). The key element in the exchange is a large, contiguous tract of State land known as Emerald Mountain, located near the town of Steamboat Springs, which would be conveyed to the BLM. For the Emerald Mountain tract, the State would receive from the private parties through WLG an amount equal to its appraised value. To complete the exchange, the BLM parcels would then be conveyed to the various private participants.

A BLM land exchange requires the conducting of a detailed resource analysis and environmental documentation, including a mineral potential report. This report determines if the Federal lands being conveyed in this case have mineral potential. It also evaluates surface use interference with potential development of the mineral estate and recommends to management what action should be taken toward disposal or retention of the Federal mineral estate. BLM Manuals 3021, 3031 and 3060, together with the BLM Land Exchange Handbook H-2200-1, provided

guidance in the preparation of this report. This report was the result of a cooperative effort by qualified BLM mineral specialists in the Little Snake Field Office, namely Mr. Allan Young, P.E., Mining Engineer and Mr. Fred Conrath, Geologist. Considerable assistance was also provided by Ms. Pam Levitt, GIS Coordinator.

Data sources used in preparing this report included oil and gas drill hole logs and reports, coal drill hole information, active and inactive coal mine data, coal mine lease applications, environmental impact statements on coal leasing and various U.S. Geological Survey and Colorado Geological Survey reports and maps. An on-site visit was conducted by the author on many of the parcels.

This report assesses the potential for mineral resources for all 121 BLM parcels being considered for exchange from the standpoint of leasable minerals, locatable minerals, and mineral materials. Specific mineral commodities addressed in the report include coal, oil and gas, geothermal energy, gold, base metals, uranium, fluorspar, and sand and gravel. The potential for mineral resources is a prediction of the likelihood of the occurrence of these resources. The occurrence of a mineral resource does not necessarily imply that the mineral can be economically exploited or is likely to be developed in the near future; mineral occurrence potential includes both exploitable and potentially exploitable occurrences.

2. Description of Exchange Lands

2.1 Location and Access

The BLM parcels being considered for exchange are distributed over a large area ("Study Area") covering the western two-thirds of Routt County, extending from the Wyoming border in the north to the town of Yampa in the south, and from the county line in the west to as far east as Steamboat Springs. Figure 1, Appendix, is a map showing the outline of the Study Area, land status, and the location of the exchange parcels. This map illustrates the scattered nature of these parcels. Most are surrounded by private land and, as such, have no public access. Hence, the difficulty involved in managing the surface use of these effectively is a strong argument for their privatization.

Table 2 is a list of parcels evaluated in this report, giving their location and legal description, size, and current mineral-related encumbrances. Gaps in the numbering sequence indicate parcels that were subsequently dropped from further consideration for exchange. Detail maps of each parcel showing adjacent landowners are included in a BLM document entitled, "Emerald Mountain Feasibility Study". A total of 32 separate townships in Routt County contain exchange parcels, together with one township in eastern Moffat County.

Table 2
List of Parcels

Parcel #	Location	Acres	Encumbrances		
			Coal Lease	Oil & Gas Lease	Right-of-Way
001	T12N R88W	79.88		COC 59206, 61738	
002	T12N R88W	147.50		COC 60937, 61063	
003	T12N R88W	40.00		COC 59661	COC 56626
004	T12N R88W	17.25		COC 61739	
005	T12N R88W	40.00			
006	T12N R88W	120.00		COC 59206	
008	T12N R87W	19.47		COC 60625	
009	T12N R87W	10.98		COC 59986	

Table 2 (Continued)
List of Parcels

Parcel #	Location	Acres	Encumbrances		
			Coal Lease	Oil & Gas Lease	Right-of-Way
011	T10N R86W	120.00			
012	T10N R86W	40.00			COC 19229
013	T10N R85W	48.09			
014	T10N R85W	24.09			
015	T10N R85W	4.87			
016	T8-9N R88-89W	875.02		COC 63297, 64223	COC 48498
017	T9N R88W	23.12		COC 64223	
018	T8-9N R88W	40.33		COC 64223	
019	T9N R88W	40.00		COC 64223	
020	T9N R88W	47.90		COC 64222	
021	T9N R86W	12.92			
022	T9N R86W	40.00			
023	T9N R86W	44.77			
024	T8N R88-89W	388.30		COC 63297, 63298	COC 36300, 49098
025	T8N R88W	77.96		COC 63295	
026	T8N R88W	40.01		COC 63297	
027	T8N R88W	48.24		COC 63297	
028	T8N R88W	74.45		COC 63297	
029	T8N R88W	40.00			
030	T8N R88W	18.66			
031	T8N R88W	36.19		COC 63300	
032	T8N R88W	39.08		COC 63300	
033	T8N R88W	592.64		COC 63303	
037	T8N R86-87W	261.94			
038	T8N R87W	120.00			
039	T8N R87W	40.00			
040	T7-8N R87W	322.44		COC 63288, 63292	
041	T8N R86W	98.70			
042	T8N R86W	1,070.78			
043	T8N R86W	11.58			
044	T8N R86W	7.56			
045	T8N R86W	21.40			
046	T8N R86W	39.84			
047	T8N R85W	756.71			
048	T8N R85W	8.06			
049	T8N R85W	8.65			
050	T8N R85W	267.17			COC 17554, 45743
051	T8N R85W	7.51			
052	T7N R88W	40.00		COC 64219	
054	T7N R88W	40.00		COC 64221	
055	T7N R88W	35.12		COC 64221	
056	T7N R88W	40.00		COC 64221	
057	T7N R88W	40.00		COC 64221	
058	T7N R87W	596.97		COC 63288, 63289	
059	T7N R86-87W	40.03		COC 39889	
060	T7N R87W	62.71		COC 39889	
061	T7N R87W	160.00		COC 63290	
062	T7N R87W	170.76		COC 39889	
063	T7N R87W	39.27		COC 39889	
064	T7N R87W	40.00			
065	T7N R86W	40.30			
066	T7N R86W	186.18		COC 39889	
067	T7N R86W	7.48			
068	T7N R86W	8.69			
069	T7N R86W	972.56			
070	T7N R86W	6.55			
071	T7N R86W	120.00			

Table 2 (Continued)
List of Parcels

Parcel #	Location	Acres	Encumbrances		
			Coal Lease	Oil & Gas Lease	Right-of-Way
073	T6N R89W	41.86		COC 57089	
076	T6N R86W	40.00			
077	T6N R86W	120.00		COC 56893	
078	T6N R84W	40.00			COC 36304, 22105, 12349
080	T5N R87-88W	160.00		COC 65978, 7796	
081	T5N R88W	40.00	COC 081258		
082	T4-5N R87-88W	202.84			
084	T5N R87W	160.00	COC 0114093	COC 0122676	
085	T5N R87W	40.00		COC 59178	COC 36303, 50064
087	T5N R87W	29.13		COC 0122676	
088	T5N R87W	80.00		COC 57715	
089	T5N R85W	9.47			COC 28495
090	T5N R85W	26.06			COC 31655
091	T4N R89W	160.00		COC 65994	
093	T4N R88W	200.00			
094	T4N R88W	480.00			
095	T4N R88W	40.00			
096	T4N R88W	40.00			
097	T4N R88W	440.00			COC 23293
098	T4N R88W	200.00			
099	T4N R87W	40.00			
101	T4N R87W	1,040.00		COC 7796, 59175, 53902	
102	T4N R86W	46.46			
104	T4N R86W	40.00		COC 64217	
104A	T4N R86W	40.00		COC 64216	COC 29365
104B	T4N R86W	40.00		COC 64216	COC 25781
104C	T4N R86W	40.00		COC 64216	
104D	T4N R86W	40.00			
105	T4N R85W	80.69			
106	T3N R88W	40.00			
107	T3N R88W	320.95			
108	T3N R88W	40.00			
109	T3N R88W	425.02			COC 0119942
110	T3N R88W	40.00			COC 28603
111	T3N R88W	40.00			
112	T3N R88W	40.00			COC 28603
113	T3N R88W	40.00			
114	T3N R87W	40.00			COC 23293
115	T3N R85-86W	229.79		COC 61729	
116	T3N R86W	136.38		COC 61729	
117	T3N R86W	10.48			
118	T3N R86W	20.98			
118A	T3N R86W	31.26			
119	T3N R86W	83.33			COC 23293
120	T3N R85W	43.21			COC 23293, 25898
121	T3N R85W	41.33			COC 17446
121A	T3N R85W	83.51			
122	T2-3N R85W	199.06			COC 31419, 0120012
123	T2N R86W	7.50			
124	T2N R86W	10.00			
125	T2N R86W	40.00			
126	T2N R86W	10.00			
128	T2N R85W	101.10			
129	T2N R85W	80.00			COC 0123869
130	T2N R85W	80.00			
131	T1N R85W	153.27			

2.2 Land Status and Encumbrances

All of the parcels evaluated in this report are currently under BLM management, with the Federal government currently holding all underlying mineral rights. At the beginning of this land exchange process, the parcels were closed to mineral entry in order to prevent nuisance claims from being filed. There currently are no valid existing unpatented mining claims on any of the parcels, nor are there any parcels with ongoing mineral materials sales contracts. Two of the parcels, 081 and 084, are situated wholly or in part within the boundaries of active coal leases COC 081258 and COC 0114093, respectively. One additional parcel, 101, partly lies within the boundary of a prior coal lease, COC 037180, now closed. There are more than 50 parcels with active oil and gas leases.

The Federal government will continue to honor all valid existing coal and oil and gas leases on parcels that are ultimately privatized under this land exchange process. This will require the government to reserve the minerals underlying each of these parcels, thereby creating a split estate ownership. Though somewhat more difficult to manage, split estate ownership is quite common in the coal and oil and gas fields of northwest Colorado.

3. Physiography

Physiographic provinces are regions of similar structure and climate that have had a unified geomorphic history. The Study Area is situated along the boundary between the Southern Rocky Mountain and Wyoming Basin provinces. It is roughly bounded on the east by the western foothills of the Park Range, on the southwest by the White River Plateau and on the northwest by the Sand Wash Basin. The east-west trending Elkhead Mountains bisect the Study Area in the north, while the Williams Fork Mountains form another prominent range in the southwest. Much of the remaining land is characterized by sagebrush-covered rolling hills, broad river valleys and low mountain ranges. Elevations are generally between 6,000 and 8,000 feet, with some isolated peaks rising to over 10,000 feet. The central portion of the Study Area is drained by the Yampa River, which flows northward from Yampa to Steamboat Springs, and then westward into Moffat County.

Important communities within or adjacent to the Study Area include Steamboat Springs, Milner, Hayden, Hahns Peak, Oak Creek, Phippsburg and Yampa, all in Routt County, and Craig in Moffat County. U.S. 40 is the main arterial highway servicing the area. Numerous State and County roads provide access north and south.

4. Geology

4.1 Geologic History

The following discussion on the geologic history of the Study Area is taken from Toth and Soulliere, U.S. Geological Survey Professional Paper 1610 (2000).

Within the Study Area, the oldest rocks are Early Proterozoic. Volcanic and sedimentary formations were accreted onto the margin of the Archean Wyoming craton and metamorphosed to gneiss, schist and migmatite at about 1.7 billion years ago. During Early and Middle Proterozoic time, these rocks were intruded by large granitic plutons. Proterozoic rocks make up the core of most of the major mountain ranges in the area, including the Park Range.

The next major geologic event occurred during early and middle Paleozoic time, when a thick sequence of marine and nonmarine sediments was deposited upon the Proterozoic rocks (Berg, 1960). In late Paleozoic time, two elements of the Ancestral Rocky Mountains, the Uncompahgre highland and the Ancestral Front Range, were formed. Uplift of the Ancestral Rockies caused older sedimentary rocks to be eroded, and in places the Proterozoic basement was partially exposed. Sedimentary rocks were deposited in a large basin that formed between the Uncompahgre and Front Range and also locally on newly exposed Proterozoic basement rocks.

During Mesozoic time, mountain-building decreased and inland seas covered the area, depositing marine and nonmarine sediments. Clastic sediments were deposited in early Mesozoic time as erosion of the highlands continued. Continental, marginal-marine, and intertonguing marine and nonmarine sediments were deposited throughout the rest of the Mesozoic.

The final exit of the sea marked the beginning of the Laramide orogeny, which produced most of the existing mountain ranges in central Colorado. During this period, plutonic rocks were emplaced along a northeast-trending zone in central Colorado coincident with major Proterozoic structures. Streams eroded older sedimentary rocks, and these deposits accumulated in structural basins formed during Late Cretaceous and Tertiary time.

During late Cenozoic time, crustal extension caused development of the present basin and ranges. Extension was accompanied by intrusion of a wide variety of granitic rocks 28 to 23 million years ago, by eruption of volcanic rocks 33 to 30 million years ago, and by intrusion and eruption of rhyolite and basalt 20 to 7.6 million years ago.

A major period of glaciation began in the area about 500,000 years ago and recurred as recently as 12,000 years ago. During the height of glaciation, ice almost totally covered the higher ranges, and the valleys were filled with glaciers.

4.2 Description of Rock Units

The following discussion on the rock units within the Study Area is taken from Toth and Soulliere, U.S. Geological Survey Professional Paper 1610 (2000) and Johnson and others, U.S. Geological Survey Professional Paper 1625-B (2000).

Mesozoic and Cenozoic rocks make up most of the Study Area. Figure 2, Appendix, is a geologic map of the area showing surface outcrops relative to the exchange parcels. Mesozoic rocks include the following sedimentary units: Lance Formation (Upper Cretaceous), Lewis Shale (Upper Cretaceous), Mesaverde Group (Upper Cretaceous), Mancos Shale (Upper

Cretaceous), Dakota Sandstone (Upper and Lower Cretaceous), Morrison Formation (Upper Jurassic), Entrada Sandstone (Middle Jurassic), Chinle Formation (Triassic), Shinarump Formation (Triassic), and Moenkopi Formation (Triassic). Paleozoic rocks of the Permian / Pennsylvanian Maroon Formation is reportedly present below the Moenkopi. Mesozoic rocks crop out within the Study Area in roughly concentric bands paralleling the margins of the Sand Wash structural basin, with the younger rock exposures in the north and west, and the older ones in the south and east.

The Mesaverde Group is composed of the Williams Fork and the Iles Formations. The Mesaverde Group is an eastward-tapering sedimentary wedge that contains a vertical succession of mixed marine and nonmarine rocks that were deposited along the western edge of the late Cretaceous Western Interior Seaway in response to a constantly shifting shoreline. Included in the Iles is the Trout Creek Sandstone Member at the top of the formation, and included in the Williams Fork is the Twentymile Sandstone Member in the middle of the formation. Both of these sandstones are regressive shoreface deposits, and each is transitional, with an underlying interval of nonmarine rocks, including fluvial sandstone, overbank sandstone and mudrock, and carbonaceous shale and coal (Johnson and others, 2000).

Tertiary rocks present within the Study Area include the following sedimentary units: Browns Park Formation (Miocene), Wasatch Formation (Eocene and Paleocene), and Fort Union Formation (Paleocene). These units were deposited in local structural basins and small grabens that formed during Tertiary time. The rocks consist of claystone, siltstone, limestone, sandstone, and conglomerate; locally they contain beds of volcanic ash. Extensive outcrops of these rocks are present in the Sand Wash Basin.

Late Miocene intrusive rocks, ranging in composition from basalt to rhyodacite and including the alkalic varieties of these compositions, crop out at

numerous locations in the northern portion of the Study Area. The more felsic rocks are concentrated in the area around Hahns Peak.

Quaternary deposits of Holocene alluvium in drainages, fans, and terraces occur within the Study Area and consist of gravel, sand, and silt. Extensive landslides of Holocene and Pleistocene age occurred in the Elkhead Mountains, and these deposits consist of shaly material with variable amounts of boulders of sandstone and basalt.

Figure 3, Appendix, is a generalized stratigraphic column with lithological descriptions of the rocks present within the Study Area.

4.3 Structural Geology

The following discussion on the structural geology within the Study Area is taken from Johnson and others, U.S. Geological Survey Professional Paper 1625-B (2000).

A major portion of the Study Area occupies the southeastern corner of the Sand Wash Basin (Tweto, 1976), and this is reflected in the gross regional structure of the area. In the western part of the Study Area, the structural dip is toward the north, but further to the east, the regional structure swings counterclockwise until, in the northeastern part of the area, the dip is toward the west. Another regional structure of significance in the area is the northwest-trending Axial Basin anticline. This structure borders the Study Area on the southwest and defines the boundary between the Sand Wash Basin on the north and Piceance Basin on the south. According to Stone (1986), this fold is a minor part of a much larger tectonic structure that extends from the Uintah Mountains in northeastern Utah to the Eagle Basin in north central Colorado, and the anticlinal nature of the fold results from the doming of strata above a southwest-vergent thrust fault. Although movement

along this regional trend might date from the Precambrian, the current Axial Basin anticline probably formed during the Laramide orogeny at the same time that smaller, subparallel folds were forming toward the north in the Study Area.

Folding in the Study Area field occurred after deposition of the Lance Formation but before deposition of the Fort Union Formation (Tweto, 1976). In the southeast part of the Study Area, the fold axes trend north-northwest and north-northeast and plunge in a southerly direction. These folds are asymmetrical, with their axial planes inclined in a westerly direction. Starting from the west, the more significant folds are the Sage Creek anticline, the Fish Creek anticline, the Twentymile Park syncline, and the Tow Creek anticline. The Twentymile syncline is doubly plunging, and a structural basin containing Lewis Shale accounts for the broad open area, or park, south of Milner.

Faulting in northwest Colorado occurred sometime in the middle or late Tertiary, and, in the Sand Wash Basin, units as young as the Miocene Browns Park Formation have been displaced (Tweto, 1976). Undoubtedly, faulting continued into the Quaternary, and the region still experiences rare, mild earthquakes. Most of the faults in the Study Area are high angle normal faults that trend northwest. Displacements are down-dropped to the northeast or southwest, and horst-and-graben structures are common. Overall, faulting has not disrupted the gross structure of the Study Area to any significant degree.

5. Minerals

The Study Area contains known occurrences of coal, oil and gas, geothermal energy, gold, copper, fluorite, uranium, and aggregates. A discussion of these occurances and their depositional environments follows.

5.1 Leasable Minerals

5.1.1 Coal

The following discussion of coal deposits within the Study Area is taken from Roberts and Molnia, U.S. Geological Survey Professional Paper 1610 (2000).

Coal beds of economic interest within the Study Area occur in the Iles and Williams Fork Formations of the Mesaverde Group. The outcrop of this group essentially defines the boundary of the highly productive Yampa Coal Field, the eastern half of which lies in Routt County and is encompassed by the Study Area. Figure 4, Appendix, is a map showing the Yampa Coal Field and the location of active and inactive coal mines within the Study Area. Here, the most important coal bearing formations commonly occupy the flanks of anticlines (USDI BLM, ca. 1976). The Upper Cretaceous Lance Formation and the Tertiary Fort Union Formation also contain coal beds of economic interest. Rock units within the Study Area that are non-coal producing include the Cretaceous Dakota, Mancos and Lewis Formations, together with the Tertiary Wasatch and Browns Park Formations. In the northern portion of the Study Area, Browns Park mostly covers Mesaverde Group rocks except in isolated exposures where Browns Park has eroded away, and in the valley of the Little Snake River. Mesaverde Group rocks generally dip to the north and west toward

Sand Wash Basin and underneath the Lewis and Lance Formations. Figure 5, Appendix, is a stratigraphic column showing the coal-producing formations.

The Mesaverde Group is separated into three separate coal-bearing zones: the Upper Coal Group, Middle Coal Group, and Lower Coal Group. The Lower Coal group consists of coal beds of the Iles Formation, between the Tow Creek and Trout Creek Sandstone Members. The number of coal beds in this group varies from 7 to 12. Cumulative coal thickness, determined from available data, ranges from 22 to 37 feet. Despite many notable past producing mines, however, this group is currently considered to be subeconomic. Near the eastern margin of the basin, where the Iles Formation is exposed at the surface, the dip of the strata containing coal is as much as 23° (Bass and others, 1955); therefore, there is only a narrow areal distribution of shallow coal away from which the overburden rapidly thickens to the west.

The Middle coal group contains the thickest and most extensive coal beds of the three groups. It is situated above the Trout Creek Sandstone and below the Twentymile Sandstone. The thickness of individual beds within the group ranges from 2 to 22 feet, and total cumulative thickness for the group reaches a maximum of 40 feet. In the eastern portion of the field, this zone contains four major coal beds: the Wolf Creek, Sage Creek, Wadge, and Lennox, in ascending order. Two of these account for virtually all of the current production from the area. The Foidel Creek Mine extracts coal from the Wadge by underground longwall methods, while the Seneca II-W and Yoast strip mines exploit both the Wolf Creek and Wadge beds. Two earlier coal strip operations, the Edna and Energy Mines, also exploited the

Wadge. At the Energy Mine, the Lennox was also mined where feasible.

The Upper coal group is situated above the Twentymile Sandstone and below the top of the Williams Fork Formation. In the eastern portion of the field, the number of coal beds and the net thickness of coal decrease to the point where this zone contains only one bed, the Fish Creek. This bed was mined, where economically feasible, at the now abandoned Energy Mine, but its thinness and high sulfur content make it currently uneconomic. In the central part of the field, coal from the Upper group was also mined at the Carey and Sleepy Cat underground mines.

Most of the coal of the Mesaverde Group is high-volatile C bituminous in apparent rank but ranges from subbituminous B to high-volatile B bituminous (Bass and others, 1955; Landis, 1959; Khalsa and Ladwig, 1981; Boreck and others, 1981). Bituminous coal occurs in multiple beds in the Iles Formation (Lower Coal Group) and in the lower half of the Williams Fork Formation (Middle Coal Group). The subbituminous coals occur in the upper half of the Williams Fork Formation (Upper Coal Group) and in the younger Lance, Fort Union, and Wasatch formations. With the exception of the coals in the Wasatch, these are subbituminous B to C in rank (USDOI BLM, 1986). Coal in the extreme eastern edge of the Yampa Coal Field is locally metamorphosed to anthracite by igneous intrusions (Bass and others, 1955). For analyses of 21 coal samples from the Yampa Coal Field, the as-received sulfur values range from 0.4 to 0.9 percent, with a geometric mean of 8.1 percent; and calorific values range from 9,870 to 12,010 Btu/lb, with a geometric mean of 11,130 Btu/lb (Khalsa and Ladwig, 1981).

The Lance Formation contains a minor amount of coal, notably the three to 10-foot-thick Lorella bed, situated about 50 feet above the base of the formation, and the 10 to 14-foot-thick Kimberley bed, located approximately in the middle of the formation (Johnson and others, 2000). The majority of and the thickest coal beds of the Lance Formation occur within less than 200 feet of the base of the formation. Most of the beds are three to four feet thick. Lance Formation coal beds are typically thin, lenticular, and difficult to trace for any distance. On the outcrop in sec. 26, T. 9 N., R. 87 W., a cumulative thickness of 21.2 feet of coal in four beds near the base of the Lance was measured in an interval of 75 feet. In the early 1920's, Lance coal was obtained from small wagon mines northeast of Craig and in T. 7 N., R. 90 W. and T. 6 N., R. 89 W. (Bass and others, 1955). Lance coal is of subbituminous B and C apparent rank (Murray, 1980) and has a calorific value, as mined, of about 9,700 Btu/lb (Bass and others, 1955).

There is also a significant amount of coal in the Fort Union Formation, notably the Seymour bed in the upper part of the formation. This bed can be as thick as 17 feet (Johnson and others, 2000). Cumulative thickness of coal in the Fort Union Formation appears to be thinning to the east toward the basin margin, however. Almost all of the coal beds occur in the lower part of the Fort Union Formation. Coal beds range in thickness from less than three feet to a maximum of 17 feet, with an average thickness of about five feet. Fort Union coals range from subbituminous B or C in apparent rank in outcrops along the southern, eastern, and northwestern margins of the basin to probably high-volatile A bituminous in the deeper parts of the Sand Wash Basin (Murray, 1980; Scott, 1993).

5.1.2 Oil and Gas

The following discussion of oil and gas deposits within the Study Area is taken from Wandrey and others, U.S. Geological Survey Professional Paper 1610 (2000).

Lands within the Study Area where Paleozoic through Tertiary sedimentary rocks occur have been intermittently explored for oil and gas since the late 1920's, and the potential for both conventional and unconventional hydrocarbon accumulations currently exist here. Conventional hydrocarbon accumulations are discrete oil and gas deposits that occur in structural, stratigraphic, and combination traps. In contrast, unconventional hydrocarbon accumulations are regionally extensive and cut across structural and stratigraphic boundaries. They also lack down-dip water contacts. Unconventional accumulations in this region include basin-centered gas and coal-bed methane.

Potential conventional reservoirs within the Study Area include the Permian and Pennsylvanian Maroon Formation; the Upper Triassic Shinarump Sandstone and Moenkopi Formation; the Middle Jurassic Entrada Sandstone and Upper Jurassic Morrison Formation; the Lower Cretaceous Dakota Sandstone; and the Upper Cretaceous Frontier Formation, Niobrara Formation, and Morapos Sandstone member of the Mancos Shale, the Mesaverde Group, and the Lewis Shale.

There are 23 oil and gas fields located within the Study Area and most are structure dependent. Table 3 is a summary of oil and gas field information. As can be seen from the table, the Niobrara Formation is the main production horizon and it yields mostly oil. Production is from porous zones within the indurated Niobrara and many of these are fracture zones at the points of highest inflection along faults and fold

structures. Reservoir sealing mechanisms must also be in place to insure entrapment of hydrocarbons by preventing leaking and migration out of the traps. All of the fields within the Study Area are extremely limited in aerial extent and many are one or two-well fields. Many dry hole wildcats have been drilled short distances away from paying wells and structure trends. Another limitation is the shallow depth to Precambrian basement rock especially in the eastern, northern and southern portions of the Study Area.

Table 3
Oil and Gas Field Summary

Field	Age	Status	Commodity	Producing Zone
Renfro Creek	Upper Cretaceous	Active	Oil	Mancos
Wolf Mountain	Upper Cretaceous		Oil	Niobrara
Trout Creek	Upper Cretaceous		Oil	Niobrara
Tow Creek	Upper Cretaceous		Oil	Niobrara
Slippery Sides	Upper Cretaceous		Oil	Niobrara
Sage Creek North	Upper Cretaceous		Oil	Niobrara
Sage Creek	Upper Cretaceous		Oil	Niobrara
Oak Creek	Triassic	Active	Oil	Shinarump
Meander	Triassic		Oil	Shinarump
Hidden Valley	Upper Cretaceous	Active	Oil	Niobrara
Grassy Creek	Upper Cretaceous		Oil	Niobrara
Focus Ranch	Tertiary	Active	Oil	Igneous Sill
Fish Creek	Upper Cretaceous		Oil	Niobrara
Dry Creek	Upper Cretaceous		Oil	Niobrara
Dill Gulch	Upper Cretaceous		Oil	Niobrara
Curtis	Upper Cretaceous	Active	Oil	Niobrara
California Par	Upper Cretaceous	Active	Oil	Niobrara
Bull Mountain	Upper Cretaceous	Active	Oil	Niobrara
Bear River	Upper Cretaceous		Oil	Niobrara
Pelt	Upper Cretaceous		Gas	Niobrara
Pagoda	Triassic	Active	Gas	Shinarump
Indian Run	Lower Cretaceous	Active	Gas	Dakota

Figure 6, Appendix, is a map showing the principal oil fields and the location of current and abandoned oil and gas wells within the Study Area. Although the possibility exists of new oil and gas fields being discovered within the Study Area, the low historical success rate combined with the limited extent of the known fields represents a significant deterrent to future exploration.

The coal-bearing units present within the Study Area, including the Upper Cretaceous Iles, Williams Fork, and Lance and the Paleocene Fort Union Formation, have the potential to produce coal-bed methane. Coal beds also occur in the Lower Cretaceous Dakota Sandstone and Upper Cretaceous Frontier Formation; however, the coal beds in these units are so lenticular and thin that they are not considered to have any potential for economic methane production. In order of decreasing coal-bed methane potential, the coal-bearing units are the Williams Fork, Iles, Lance, and Fort Union. Coal-bed methane is low in sulfur, and water may be fresh to brackish with moderate bicarbonate content. In the absence of specific test data, it can be assumed that all coal beds in the Study Area contain gas; however, the presence of large amounts of water in coals commonly precludes economic rates of gas production. In areas like the San Juan Basin of New Mexico and Colorado, dewatering programs have been successful, and structural or stratigraphic traps are not necessary for production. However, in other areas, where there are large amounts of water associated with the coal that cannot be economically dewatered, structural traps are necessary for economic rates of gas production (Rice and others, 1993).

5.1.3 Geothermal Energy

Two areas of geothermal activity are present within the Study Area. In the Steamboat Springs area, two groups of thermal springs are of interest (USDOI BLM, 1986). Routt Hot Springs, approximately six miles north of town, has water measured at 64 degrees Centigrade (147° F), with a measured flow of 114 liters per minute (30 gallons per minute) containing 530 parts per million total dissolved solids. Heart Springs, in the town of Steamboat Springs, has water temperatures of 39 degrees Centigrade (102° F), with a measured flow of 76 liters per

minute (20 gallons per minute) and total dissolved solids content of 6,170 parts per million. Other thermal springs in the town area have temperatures of 20 to 26 degrees Centigrade (68 to 79° F). These occurrences are included within an extensive known geothermal area defined by the U.S. Geological Survey, known as the Steamboat Springs Area of Geothermal Potential (Rold, 1975). The area encompasses all or portions of T. 8 N. to T. 2 N. by R. 83 W. to R. 86 W. in Routt County.

To the west of this area lies the Tow Creek Area of Geothermal Potential (Rold, 1975). The U.S. Geological Survey defines this area as encompassing all or part of T. 7 N. to 5 N. by R. 85 W. to R. 87 W.

As defined by Pearl, geothermal occurrences of less than 90 degrees Centigrade are characterized as low-temperature systems. The areas identified within the Study Area are most likely low temperature in character. Demand is, and would be anticipated to remain, essentially local in nature.

5.1.4 Other Leasable Minerals

Helium occurrences have been reported in the Williams Park gas field south of Tow Creek (Rold, 1975).

5.2 Locatable Minerals

5.2.1 Gold

Placer gold occurrences are found at a number of locations within the Study Area. The most important of these is in the Hahns Peak area north of Steamboat Lake, where gold placers were worked during the

late 19th and early 20th century. These placers were found in Quaternary alluvium, and many are now covered by Steamboat Lake.

In addition to placer gold, lode gold occurrences also exist within the Study Area (Rold, 1975). Several lode gold occurrences exist in the area surrounding and including Hahns Peak, where it is associated with silver and lead. Gold has been reported from the Elkhorn Mine in the extreme northern portion of the Study Area, where it is also associated with silver and lead in Precambrian metamorphic rocks. Another lode gold occurrence is in the Elk Mountain area east of Mystic, where copper is also reported. This occurrence is related to a Tertiary intrusive in Mancos Shale.

5.2.2 Base Metals

Several occurrences of base metal mineralization are found within the Study Area (Rold, 1975). According to Soulliere and Toth (2000), the Hahns Peak area is highly prospective for stockwork molybdenum. In the extreme north, copper and lead, as well as silver, are found in the area east of the confluence of the North Fork and Middle Fork of the Little Snake River. Southwest of Clark, at the Greenville Mine, lead, zinc, copper and silver mineralization is reported. A small copper occurrence is also reported from the Copper Ridge area east of Mad Creek. These occurrences are all in Precambrian rocks. By and large, the younger (Cretaceous and Tertiary) rocks within the Study Area do not appear to have a high degree of potential for significant base and/or precious metal mineralization (USDOI BLM, 1986).

5.2.3 Uranium

There are three reported occurrences of uranium minerals within the Study Area (Rold, 1975). Two are east and southeast of Steamboat Springs, in the Fish Creek and Burgess Creek drainages, respectively. The Fish Creek occurrence is developed by a small adit in Precambrian metamorphic rocks. The third occurrence is hosted in Browns Park Formation east of City Mountain in the northern portion of the Study Area.

5.2.4 Fluorspar

Fluorite mineralization has been reported within the Study Area in T. 7 and 8 N., R. 86 W. This mineralization is associated with Tertiary intrusives in Cretaceous sedimentary rocks of the Mancos Shale.

5.3 Mineral Materials

5.3.1 Sand and Gravel

Sand and Gravel occurs throughout the Study Area and is found in alluvial and colluvial deposits (USDOI BLM, 1986). Alluvial deposits are found along major and tributary drainage courses, such as the Yampa and Elk rivers, as well as on benches and terraces above the present drainages. Colluvial deposits are found at the base of essentially any bedrock outcrop of appreciable relief and within alluvial fans associated with the larger drainages.

Additional sources are semi-consolidated horizons in older geologic units, such as the basal conglomerate of the Browns Park Formation. These deposits vary, depending on their source materials, geologic

history, and geomorphic setting. Deposits within the resource area are large, but since they are of low unit-value, their significance is principally local.

5.3.2 Scoria

Scoria is a local term for naturally baked and thermally altered shale or clay resulting from the in-place combustion of adjacent coal beds. Potential resources are only of local significance and are frequently found in association with coal beds at various localities within the Study Area (USDOI BLM, 1986). It is used in road armor and as lightweight aggregate.

5.3.3 Clays and Shales

At least two rock units found within the Study Area, the Tertiary Fort Union and Wasatch Formations, contain clays or shales of potential resource significance (USDOI BLM, 1986). Other horizons in Cretaceous rocks may also be important. Clays and shales can be used as sources for expanded aggregate, pozzolanic admixtures, bentonitic material, and brick manufacture. For the most part, potential resource locations have yet to be identified, and usage will most likely be local to regional.

5.3.4 Other Mineral Materials

Unconsolidated rubble or fault breccia has been mined from several sites within the Study Area (Rold, 1975). This material is used for road base and road armor.

A travertine resource area, associated with previous hot springs activity, has been identified south of Steamboat Springs (Rold, 1975).

Two building stone quarries are located within the Study Area. One is north of Glen Eden, while the other is southwest of Steamboat Springs (Rold, 1975). Both quarries apparently mined stone from outcrops of the Dakota Formation.

Metamorphosed shale has been mined from two locations within the Study Area: one from Morgan Creek in T. 7 N., R. 88 W., and the other from south of Rattlesnake Butte in T. 7 N., R. 86 W. (Rold, 1975). The first site is in Cretaceous Lewis Formation, while the second is in the Mancos. Both are in the vicinity of Tertiary igneous intrusives.

6. Production and Resources

Production and resource data are available for coal and oil and gas only within the Study Area, and these are discussed below.

6.1 Coal

From 1864 through 1995, coal production from Routt County (i.e. the Study Area) has totaled more than 173 million tons (Tremain and others, 1996). Most of this production has come from underground mines in the Yampa Coal Field. Continued production since then from the Seneca and Twentymile Coal Company operations has pushed this production figure to over 240 million tons. Only a very small fraction of this production has come from proposed exchange parcels.

Published estimates of coal resources for the region encompassed by the Study Area and for individual coal tracts within the Study Area have been made by a number of individuals over the past several years. Recently, Carroll and Morgan (2000) completed a “demonstrated reserve base” estimate for the upper and middle coal groups of the Williams Fork Formation, Yampa Coal Field. This estimate totaled some 1.8 billion tons for that portion of the field lying within Routt County. Only measured and indicated resources were included, so areas with little or no drill hole information were not assigned any tonnage. A similar estimate by Johnson and others (2000) used a much less rigorous standard of certainty and resulted in a total resource potential of almost 9.4 billion tons for this same area. A number of proposed exchange parcels contain potential coal resources.

6.2 Oil and Gas

Since the 1920's, approximately 390 oil and gas wells have been drilled within the Study Area. Of this number, 68 were producers. Currently, there are 21 wells still producing. During the past 15 years, only two new conventional wells have been drilled on Federal leases within the Study Area, and they have been dry holes. The target was steeply dipping fractures in the Niobrara Formation, using horizontal drilling techniques. Two other Federal coal bed methane wells have been drilled in recent years, together with several fee wells. None of these have commercial production at this time. Copious quantities of produced water have hampered coal bed methane viability in these projects.

7. Mineral Potential

7.1 Methodology

This report assesses the potential for mineral resources for all 121 BLM parcels being considered for exchange from the standpoint of leasable minerals, locatable minerals, and mineral materials. The potential for mineral resources is a prediction of the likelihood of the occurrence of these resources. In assessing mineral potential, a number of geologic factors were evaluated to determine whether a favorable geologic environment existed for the formation of minerals. These factors include: favorable rocks, favorable geologic structure, evidence of rock alteration, geochemical evidence, geophysical evidence, evidence from mineral occurrences, and evidence from other sources.

For each exchange parcel, an assessment of mineral potential was completed for leasable minerals, locatable minerals, and mineral materials. Based on the available data concerning a particular exchange parcel, potential was assessed according to the Mineral Potential Classification System included in BLM Manual 3031. This system provides for a ranking of the level of potential as well as the level of certainty. The level of potential for the accumulation of mineral resources, as indicated by the geologic environment (e.g. favorable rock units), the inferred geologic processes, reported mineral occurrences, valid geochemical and/or geophysical anomalies, and by the presence of known mines or deposits, is ranked as follows:

O – No potential

L – Low potential

M – Moderate potential

H – High potential

ND – Not determined (due to lack of data)

The level of certainty is ranked as to the ability of the data to support or refute the possible existence of mineral resources, as follows:

A – Data is insufficient and/or cannot be considered as evidence.
B – Data provides indirect evidence.
C – Data provides direct evidence but are quantitatively minimal.
D – Data provides abundant direct and indirect evidence.

When known, the quantity of the resource was also included in the assessment of mineral potential.

7.2 Assumptions

A geologic map of Routt County (Miller, 1975) was used to identify surface rocks within each of the parcels. Many of the parcels were visited by the author in order to verify the map.

In assessing coal potential, only those beds that were of mineable thickness and less than 2,000 feet deep were considered. Overburden information was obtained from oil and gas well logs and from work done by Johnson and others (2000). Where no other information is available, coal quality is assumed to be high-volatile C bituminous in the Iles Formation (Lower Coal Group) and the Williams Fork Formation between the Twentymile and Trout Creek Sandstone Members (Middle Coal Group). Coals of the Upper Coal Group of the Williams Fork Formation, the Lance Formation, and the Fort Union Formation are assumed to be subbituminous B in rank.

A mineral resources map of Routt County (Rold, 1975) was used to identify aggregate and other mineral material resources within individual parcels.

7.3 Potential of Exchange Parcels

A discussion of the mineral potential for each exchange parcel, together with their respective potential and certainty ranking, is presented in the Appendix.

References Cited

Bass, N.W., Eby, J.B. and Campbell, M.R., 1955, Geology and mineral fuels of parts of Routt and Moffat Counties, Colorado: U.S. Geological Survey Bulletin 1027-D, p. 143-250.

Berg, R.R., 1960, Cambrian and Ordovician history of Colorado, *in* Weimer, R.J., and Haun, J.D., eds., The Geology of Colorado: Denver, Geological Society of America, Rocky Mountain Association of Geologist, and Colorado Scientific Society, p. 10-16.

Boreck, D.L., Tremain, C.M., Sitowitz, L., and Lorenson, T.D., 1981, The coal bed methane potential of the Sand Wash Basin, Green River coal region, Colorado: Colorado Geological Survey Open-File Report 81-6, 24 p.

Carroll, C.J., and Morgan, M.L., 2000, Demonstrated Reserve Base for Coal in Colorado: Yampa Coal Field: Colorado Geological Survey Open-File Report 00-12, 33 p.

Colorado Geological Survey, ca. 2002, Surface geology of the BLM Little Snake Resource Area shapefile.

Johnson, E.A., Roberts, L.N.R., Brownfield, M.E., and Mercier, T.J., 2000, Geology and Resource Assessment of the Middle and Upper Coal Groups in the Yampa Coal Field, Northwestern Colorado: U.S. Geological Survey Professional Paper 1625-B, 63 p.

Kaiser, W.R., 1993, Abnormal pressure in coal basins of the western United States, in Proceedings of the 1993 International Coalbed Methane Symposium, p. 173-186.

Kaiser, W.R., Scott, D.S., Hamilton, D.S., Tyler, R., McMurry, R.G., and Zhou, N., 1993, Geologic and hydrologic controls on coalbed methane: Sand Wash Basin, Colorado and Wyoming: GRI Topical Report GRI-92/0420, 151 p.

Khalsa, N.S., and Ladwig, L.R., 1981, Colorado Coal Analyses 1976-1979: Colorado Geological Survey Information Series 10, 364 p.

Landis, E.R., 1959, Coal resources of Colorado, *in* Contributions to Economic Geology: U.S. Geologic Survey Bulletin 1072-C, p. 131-232.

McCord, J.P., 1984, Geologic overview, coal, and coalbed methane resources of the Greater Green River coal region – Wyoming and Colorado, *in* Rightmire, C.T., Eddy, G.E., and Kirr, J.N., eds., Coal-Bed Methane Resources of the United States: American Association of Petroleum Geologists Studies in Geology Series no. 17, p. 271-273.

Miller, A.E., 1975, Geologic, Energy and Mineral Resources Maps of Routt County, Colorado: Colorado Geological Survey, 2 p.

Murray, D.K., 1980, 1979 Summary of coal resources in Colorado: Colorado Geological Survey Special Publication 13, 24 p.

PI / Dwights PLUS, 2003, Digital well data on CD ROM.

Rice, D.D., Law, B.E., and Clayton, J.L., 1993, Coal-bed gas - An undeveloped resource, in Howell, D.G., ed., The Future of Energy Gases: U.S. Geological Survey Professional Paper 1570, p. 389-404.

Roberts, L.N.R., and Molnia, C.L., 2000, Mineral resources – leaseable minerals, *in* Bankley, V., Soulliere, S.J., and Toth, M.I., eds., Mineral Resource Potential and Geology of the Routt National Forest and the Middle Park Ranger District

of the Arapaho National Forest, Colorado: U.S. Geological Survey Professional Paper 1610, 112 p.

Rold, J.W., 1975, Energy and minerals resources map, Routt County, Colorado, *in* Miller, A.E., Geologic, Energy and Mineral Resources Maps of Routt County, Colorado: Colorado Geological Survey, 2 p.

Scott, A.R., 1993, Coal rank, gas content, and composition and origin of coalbed gases, Fort Union Formation, Sand Wash Basin, *in* Kaiser, W.R., Scott, A.R., Hamilton, D.S., Tyler, R., McMurry, R.G., Zhou, N., and Tremain, C.M., eds., Geologic and Hydrologic Controls on Coal-Bed Methane – Sand Wash Basin, Colorado and Wyoming: Gas Research Institute Topical Report GRI-92/0420, p. 107-113.

Stone, D.S., 1986, Seismic and borehole evidence for important pre-Laramide faulting along the Axial arch in northwest Colorado, *in* Stone, D.S., ed., New Interpretations of Northwest Colorado Geology: Rocky Mountain Association of Geologists, p. 19-36.

Toth, M.I., and Soulliere, S.J., 2000, Geology, *in* Bankley, V., Soulliere, S.J., and Toth, M.I., eds., Mineral Resource Potential and Geology of the Routt National Forest and the Middle Park Ranger District of the Arapaho National Forest, Colorado: U.S. Geological Survey Professional Paper 1610, 112 p.

Tremain, C.M., 1990, Coalbed methane development in Colorado: Colorado Geological Survey, Information Series 32, 35 p.

Tremain, C.M., Hornbaker, A.L., Holt, R.D., Murray, D.K., and Ladwig, L.R., 1996, 1996 summary of coal resources in Colorado: Colorado Geological Survey Special Publication 41, 19 p.

Turney, J.E., and Murray-Williams, L., 1984, Inactive Coal Mine Data and Subsidence Information, Yampa Valley Region, 40 p.

Tweto, Ogden, 1976, Geologic map of the Craig 1º x 2º quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-972, scale 1:250,000.

U.S. Department of the Interior, Bureau of Land Management, ca. 1976, Final Environmental Statement, Northwest Colorado Coal, p. II-1–II-16.

U.S. Department of the Interior, Bureau of Land Management, 1986, Little Snake Resource Management Plan and Environmental Impact Statement, Draft, p. 3-4–3-35.

Wandrey, C.J., Law, B.E., Spencer, C.W., and Barker, C.E., 2000, Oil, gas, and coal-bed methane resources, *in* Bankley, V., Soulliere, S.J., and Toth, M.I., eds., Mineral Resource Potential and Geology of the Routt National Forest and the Middle Park Ranger District of the Arapaho National Forest, Colorado: U.S. Geological Survey Professional Paper 1610, 112 p.

MINERAL POTENTIAL REPORT
EMERALD MOUNTAIN LAND EXCHANGE
ROUTT COUNTY, COLORADO

PARCEL NO. 001

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Williams Fork Formation outcrops approximately 1 mile north of parcel. Probably underlying Browns Park in this area is the Williams Fork Formation. No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 3 miles south of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 3 miles northwest of the two well Focus Ranch field. Oil is produced from this field from Tertiary igneous sills. There are no active or abandoned wells within this parcel. The Cantling Creek #1 well is 2.4 miles to south and the Ely Federal #1 well 1.9 mile to the southwest. Both are dry holes with no production. This parcel is encumbered by two oil and gas leases, COC-59206 and COC-61738. This parcel has a low oil and gas potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 002

General Geology: Surface mapped as Williams Fork Formation and Quaternary alluvium along Little Snake River (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 3.5 miles south of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 3.6 miles northwest of the two well Focus Ranch field. Oil is produced from this field from Tertiary igneous sills. There are no active or abandoned wells within this parcel. The Cantling Creek #1 well is 2.5 miles to south and the Ely Federal #1 well 2.5 miles to the southwest. Both are dry holes with no production. This parcel is encumbered by two oil and gas leases, COC-60937 and COC-61063. This parcel has a low oil and gas potential based on indirect evidence.

Locatable Minerals: The Little Snake River drains areas of known gold occurrences, including Hahns Peak. Placer gold has also been mined along the river downstream of the parcel. Considering the favorable geologic environment and previous mining along the same river, there is moderate potential for placer gold in the river gravels within the parcel, but data is insufficient.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill aggregate resource to exist within the parcel, based on direct visual evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 003

General Geology: Surface mapped as Lewis Formation (Miller, 1975). Williams Fork Formation outcrops approximately 1 mile north of parcel. Probably underlying Lewis in this area is the Williams Fork Formation. Tertiary volcanics outcrop 0.5 mile to the south. No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 4.5 miles southeast of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: The Slater Dome gas field is approximately 2.4 miles due west of this parcel. There are no active or abandoned wells within this parcel. This parcel is encumbered by one oil and gas lease, COC-59661. This parcel has a low oil and gas potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 004

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Williams Fork Formation outcrops approximately 0.5 mile north of parcel. Probably underlying Browns Park in this area is the Williams Fork Formation. No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 3.5 miles southeast of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately midway between the Focus Ranch field and the Slater Dome field. Both are very small fields with limited aerial extent. There are no active or historic wells on this parcel. The parcel is encumbered by oil and gas lease COC-61739. There is a low potential for oil and gas development, based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 005

General Geology: Surface mapped as Browns Park Formation in north half of parcel, with Tertiary volcanics outcropping in the south half (Miller, 1975). Williams Fork Formation outcrops approximately 1 mile north of parcel. Probably underlying Browns Park in this area is the Williams Fork Formation. No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 2.5 miles southeast of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: This parcel is about 1.4 miles north of the Cantling Creek #1 well. This well is a dry hole with no production of oil or gas. This parcel does not have any oil and gas leases on it. As a result this parcel has low potential for oil and gas development, based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 006

General Geology: Surface mapped as Browns Park Formation within the parcel, with Tertiary volcanics outcropping along the northern boundary (Miller, 1975). Williams Fork Formation outcrops approximately 1.5 mile north of parcel. Probably underlying Browns Park in this area is the Williams Fork Formation. No known faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 1.5 mile southeast of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: This parcel is about 0.7 mile northwest of the Cantling Creek #1 well. This well is a dry hole and has no production. The parcel is encumbered by oil and gas lease COC-59206. This parcel has low potential for oil and gas, based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 008

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Williams Fork Formation outcrops approximately 0.5 mile north of parcel. Probably underlying Browns Park in this area is the Williams Fork Formation. No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 2.5 miles south of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: This parcel is located 2.2 miles northwest of the two well Focus Ranch field and 1 mile north of the Ely Federal #1 well which is a dry hole with no production. This parcel is encumbered by oil and gas lease COC-60625 and has low potential, based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 009

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Williams Fork Formation outcrops approximately 0.2 mile north of parcel. Probably underlying Browns Park in this area is the Williams Fork Formation. No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 2.5 miles southwest of the parcel, the Williams Fork Formation contains coal beds of mineable thickness at a depth of less than 2,000 feet. Considering the favorable geologic environment and reported coal occurrence, there is moderate potential for coal within the parcel, based on indirect evidence.

Oil & Gas: The parcel is located approximately 1 mile northwest of the Focus Ranch field. This field has one well producing from igneous intrusives. This kind of trap is extremely limited in aerial extent. The parcel is encumbered by oil and gas lease COC-59986 and has low potential base on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 011

General Geology: Surface mapped as Tertiary volcanics along the northern boundary and within the southern portion of the parcel. Browns Park Formation mapped in the remainder of the parcel (Miller, 1975). Probably underlying Browns Park in this area is the Mancos or Dakota formation, or possibly Jurassic rocks. Approximately 0.5 mile to the north is an east-west trending, high-angle fault, with the down-dropped side to the south.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Low potential for oil and gas based on indirect evidence. No oil and gas leases on this parcel.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 012

General Geology: Surface mapped as Tertiary volcanics within the northern and western portions of the parcel. Browns Park Formation mapped in the remainder of the parcel (Miller, 1975). Probably underlying Browns Park in this area is the Mancos or Dakota Formation, or possibly Jurassic rocks. Approximately 0.5 mile to the north is an east-west trending, high-angle fault, with the down-dropped side to the north.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Low potential for oil and gas based on indirect evidence. No oil and gas leases on this parcel.

Locatable Minerals: Low potential for locatable minerals within parcel, based on direct visual evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on direct visual evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 013

General Geology: Surface mapped as an outcrop of Tertiary volcanics within parcel, surrounded by Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. Along the northern boundary of the parcel is an east-west trending, high-angle fault, with the down-dropped side to the south.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Low potential for oil and gas based on indirect evidence. No oil and gas leases on this parcel.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 014

General Geology: Surface mapped as Quaternary unconsolidated colluvium (Miller, 1975). Material appears to be composed of moderately rounded cobbles and gravel, which has probably been washed down from the Hahns Peak area. Probably underlying Quaternary deposits in this area is the Browns Park Formation and, below that, Mancos Shale. Approximately 0.2 mile north of the parcel is an east-west trending, high-angle fault, with the down-dropped side to the south.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Low potential for oil and gas based on indirect evidence. No oil and gas leases on this parcel.

Locatable Minerals: Hahns Peak, the probable source of the gravels found within the parcel, is an area of known gold occurrences. Immediately to the east of the parcel lies a previously active placer gold mine, probably operated around the turn of the 20th century. Considering the favorable geologic environment and the proximity to a known placer mine, there is moderate potential for placer gold in the gravels underlying the parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill gravel resource to exist within the parcel, based on direct visual evidence.

Overall Ranking:

Potential	M
Certainty	C

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 015

General Geology: Surface mapped as Quaternary unconsolidated colluvium (Miller, 1975), probably washed down from the Precambrian basement rocks of the Park Range. Probably underlying Quaternary deposits in this area are Precambrian basement rocks. Approximately 0.2 mile north of the parcel is an east-west trending, high-angle fault, with the down-dropped side to the south. To the west is the trace of a north-south trending thrust fault, with the parcel lying on the upper plate of the thrust.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Low potential for oil and gas based on indirect evidence. No oil and gas leases on this parcel.

Locatable Minerals: Although Precambrian basement rocks occasionally host precious and base metal vein deposits, there is no evidence of any such deposits or previous mining activity in the area. The parcel therefore has low potential for locatable minerals, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 016

General Geology: Surface mapped as Lance Formation in the central portion of the parcel, with Wasatch Formation in the northern and western portions (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas leases COC-63297 and COC-64223. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 7 miles to the southeast. The nearest well is a dry hole 4.6 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on direct visual evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on direct visual evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 017

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64223. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 7.1 miles to the southeast. The nearest well is a dry hole 4.2 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 018

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64223. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 6.4 miles to the southeast. The nearest well is a dry hole 3.5 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 019

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64223. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 6.5 miles to the southeast. The nearest well is a dry hole 3.4 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 020

General Geology: Surface mapped as Lance Formation in southern portion of parcel, with Tertiary volcanics outcropping along northern boundary (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64222. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 6.4 miles to the south. The nearest well is a dry hole 3.6 miles to the south. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 021

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos or Dakota Formation, or possibly Jurassic rocks. No faults or folds noted. Negligible gravel development in creek bed.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Low potential for oil and gas based on indirect evidence. No oil and gas leases on this parcel.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 022

General Geology: Surface mapped as Browns Park Formation, with Tertiary volcanics along the northeast corner (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several shallow wells have been drilled within 2.5 miles of this parcel. All the wells are fairly shallow abandoned dry holes. This parcel is not encumbered by an oil and gas lease and has a low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 023

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several shallow wells have been drilled within 2.5 miles of this parcel. All the wells are fairly shallow abandoned dry holes. This parcel is not encumbered by an oil and gas lease and has a low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 024

General Geology: Surface mapped as Lance Formation (Miller, 1975). One coal bed less than 1' thick noted in creek bank. Gravel in creek bottom and on ridge top, poorly sorted, with large boulders. No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas leases COC-63297 and COC-63298. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 6.9 miles to the southeast. The nearest well is a dry hole 3.5 miles due east. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for an upland gravel resource to exist within the parcel, based on direct visual evidence.

Overall Ranking:

Potential	M
Certainty	C

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 025

General Geology: Surface mapped as Lance Formation, with Tertiary volcanics outcropping along southwest boundary of parcel (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63295. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 4.8 miles to the south. The nearest well is a dry hole 1.9 mile to the south. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 026

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63297. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.8 miles to the southeast. The nearest well is a dry hole 2.8 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 027

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63297. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.8 miles to the southeast. The nearest well is a dry hole 2.8 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 028

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63297. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 6.1 miles to the southeast. The nearest well is a dry hole 3.2 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 029

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.5 miles to the southeast. The nearest well is a dry hole 2.8 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 030

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.6 miles to the southeast. The nearest well is a dry hole 3.4 miles to the east. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 031

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63300. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.5 miles to the southeast. The nearest well is a dry hole 2.8 miles to the southeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 032

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63300. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.9 miles to the southeast. The nearest well is a dry hole 4.4 miles to the northeast. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 033

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63303. There are no current or historic wells on this parcel. The nearest producing field is the Bull Mountain field 5.1 miles due east. The nearest well is a CBM wildcat 4.0 miles due east. These wells are not producing gas, but instead huge quantities of water. As a result this parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 037

General Geology: Surface mapped as Iles Formation in the western portion of the parcel, with Mancos in the eastern portion (Miller, 1975). Along the northeastern boundary of the parcel is a narrow outcrop of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 0.2 mile to the north is the inactive Block Mine, which mined 4.3 to 7-foot coal beds from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: The parcel is located between the Renfro Creek oil field, which produces from the Mancos Shale, and the Bull Mountain oil field, which produces from the Niobrara. Both oil fields are small in the number of wells and aerial extent. Several dry holes have been drilled to the south and north and just outside the delineated boundary of the Renfro Creek field. This parcel is not encumbered by an oil and gas lease and has low potential for oil and gas development.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 038

General Geology: Surface mapped as Iles Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 0.5 mile to the north is the inactive Keitel Mine, which mined from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: The parcel is located between the Renfro Creek oil field, which produces from the Mancos Shale, and the Bull Mountain oil field, which produces from the Niobrara. Both oil fields are small in the number of wells and aerial extent. Several dry holes have been drilled to the south and north and just outside the delineated boundary of the Renfro Creek field. This parcel is not encumbered by an oil and gas lease and has low potential for oil and gas development.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 039

General Geology: Surface mapped as Iles Formation (Miller, 1975). Along the western boundary of the parcel is a narrow outcrop of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 0.5 mile to the south is the inactive Peacock Mine, which mined 7-foot coal beds from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: The parcel is located between the Renfro Creek oil field, which produces from the Mancos Shale, and the Bull Mountain oil field, which produces from the Niobrara. Both oil fields are small in the number of wells and aerial extent. Several dry holes have been drilled to the south and north and just outside the delineated boundary of the Renfro Creek field. This parcel is not encumbered by an oil and gas lease and has low potential for oil and gas development.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 040

General Geology: Surface mapped as Lewis Formation in the western and central portion of the parcel, with Williams Fork in the eastern portion (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: In the western portion of the parcel, the coal bearing Williams Fork Formation (Upper Coal Group) is at a relatively shallow depth. Located approximately 2 miles to the north is the inactive Rolfes Mine, which mined an 8-foot coal bed from the Upper Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is less than a mile south of the Bull Mountain oil field, which has production from the Niobrara. This parcel is encumbered by oil and gas leases COC-63288 and COC-63292 and has moderate potential for the development of oil and gas resources.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 041

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. Low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for locatable minerals within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 042

General Geology: Surface mapped as Iles Formation in the western portion of the parcel, with Mancos in the eastern portion (Miller, 1975). Along the northern boundary of the parcel is a narrow outcrop of Tertiary volcanics. Approximately 0.5 mile east of the parcel is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 0.5 mile to the north is the inactive Shelton Mine, which mined 10 to 12-foot coal beds from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. This parcel is located approximately a mile north of the Renfro Creek field. This parcel has a low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 043

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. Approximately 1 mile west of the parcel is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. This parcel has low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 044

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. Approximately 0.5 mile west of the parcel is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. This parcel has low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 045

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Approximately 1 mile northwest of the parcel is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. There are several dry holes that have been drilled about a mile south of this parcel. This parcel has low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 046

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Approximately 0.5 mile northwest of the parcel is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. There are several dry holes that have been drilled about a mile south of this parcel. This parcel has low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 047

General Geology: Surface mapped as Browns Park Formation, with Mancos Shale exposed along eastern boundary of parcel (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. Low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 048

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. Low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 049

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. Low potential for oil and gas based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 050

General Geology: Surface mapped as Triassic and Permian rocks in the north and west portion of the parcel, with Precambrian basement rocks of the Park Range in the south and east portion (Miller, 1975). Along the northwest boundary of the parcel is the projected trace of a north-south trending thrust fault, with the parcel lying on the lower plate of the thrust.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. This parcel has a low potential for oil and gas based on indirect evidence.

Locatable Minerals: Although Precambrian basement rocks occasionally host precious and base metal vein deposits, there is no evidence of any such deposits or previous mining activity in the area. The parcel therefore has low potential for locatable minerals, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 051

General Geology: Surface mapped as Mancos Shale and Quaternary alluvium. The parcel follows the projected trace of a north-south trending thrust fault, with the upper plate to the west.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: There are no current or historical oil and gas wells and no oil and gas leases on this parcel. There are several dry holes that have been drilled about a mile south of this parcel. This parcel has low potential for oil and gas based on indirect evidence.

Locatable Minerals: The Elk River drains areas of known gold occurrences, including Hahns Peak. Placer gold has also been mined upstream of the parcel. Considering the favorable geologic environment, there is moderate potential for placer gold in the river gravels underlying the parcel, but data is insufficient.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for an upland aggregate resource to exist within the parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 052

General Geology: Surface mapped as Lewis Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Based on projections from an oil and gas well 1.5 mile east of the parcel, the coal bearing Williams Fork, which underlies the Lewis, is projected to be over 2,000 feet deep at this location. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is approximately a mile southwest of a pilot project of CBM wells, which have produced no commercial gas, but that have produced much water. The pilot is just west of the Bull Mountain field. Lease COC-64219 encumbers this lease, but there are no existing or historical wells on this parcel. This parcel is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 054

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not near any oil and gas fields and there are no current or historical wells that have been drilled on it. The nearest well is three miles to the southeast and it is a dry hole. This parcel is encumbered by oil and gas lease COC-64221. There is a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 055

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Although the Lance Formation is known to contain mineable coal beds several miles to the south, there is no drilling data, outcrops or previous mining in this area to suggest that mineable coal beds may underlie the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not near any oil and gas fields and there are no current or historical wells that have been drilled on it. The nearest well is three miles to the southeast and it is a dry hole. This parcel is encumbered by oil and gas lease COC-64221. There is a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 056

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: The Lance Formation is known to contain mineable coal beds. Located approximately 3 miles to the south is the inactive Lorella Mine, which mined the 6.5-foot thick Lorella bed (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not near any oil and gas fields and there are no current or historical wells that have been drilled on it. The nearest well is 0.8 mile to the southeast and it is a dry hole. This parcel is encumbered by oil and gas lease COC-64221. There is a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 057

General Geology: Surface mapped as Lance Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: The Lance Formation is known to contain mineable coal beds. Located approximately 2.5 miles to the south is the inactive Lorella Mine, which mined the 6.5-foot thick Lorella bed (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not near any oil and gas fields and there are no current or historical wells that have been drilled on it. The nearest well is 0.5 mile to the northeast and it is a dry hole. This parcel is encumbered by oil and gas lease COC-64221. There is a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 058

General Geology: Surface mapped as Lewis Formation in the western portion of the parcel, with Williams Fork and Iles in the central and eastern portion (Miller, 1975). Cutting across the central portion of the parcel in a northwest-southeast direction is a narrow outcrop of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: The Williams Fork and Iles Formations are exposed within the parcel. Located approximately 1.5 mile to the north are the inactive Deep Creek and Franz mines, which mined 4.5 to 8-foot coal beds from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is located between the Bull Mountain oil field 1.5 mile to the north and the Wolf Mountain oil field 1.5 mile to the south. Several wells are drilled just outside the Wolf Mountain field delineated boundary are dry holes. This parcel is encumbered by two oil and gas leases COC-63288 and COC-63289, but no wells have been drilled on this parcel. This parcel has low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 059

General Geology: Tertiary volcanics outcrop in the western portion of the parcel, with Mancos Shale in the eastern portion (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Parcel is in Tow Creek area of geothermal potential (Miller, 1975). Considering this, the parcel has moderate potential for geothermal energy, but data is insufficient.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-39889 and at lease four dry holes have been drilled in close proximity. No wells have been drilled on this parcel. This parcel is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	A

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 060

General Geology: Surface mapped as Mancos Shale, with Tertiary volcanics along the southern and northern boundary of the parcel (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Parcel is in Tow Creek area of geothermal potential (Miller, 1975). Considering this, the parcel has moderate potential for geothermal energy, but data is insufficient.

Oil & Gas: This parcel is approximately 0.5 mile northeast of the Wolf Mountain oil field and it is encumbered by oil and gas lease COC-39889. It has no current or historical wells drilled on it. The Wolf Mountain field is limited in aerial extent and wells drilled immediately outside of its delineated boundary have all been dry. This parcel is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	A

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 061

General Geology: Surface mapped as mainly Tertiary volcanics, with Lewis Formation along the southern boundary of the parcel (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-63290, but no wells have been drilled on this parcel. This parcel is not near any producing wells or fields and is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: A metamorphosed shale pit lies approximately 1 mile to the southwest and adjacent to a Tertiary volcanic outcrop. Considering the proximity to a known deposit with similar geology, there is moderate potential for a metamorphosed shale resource within parcel, but data is insufficient.

Overall Ranking:

Potential	M
Certainty	A

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 062

General Geology: Surface mapped as Iles Formation in the western portion of the parcel, with Mancos in the eastern portion (Miller, 1975). In the northwestern portion of the parcel is a narrow outcrop of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 1 mile to the south is the inactive Moorehouse Mine, which mined 3.9 to 4.4-foot coal beds from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Parcel is in Tow Creek area of geothermal potential (Miller, 1975). Considering this, the parcel has moderate potential for geothermal energy, but data is insufficient.

Oil & Gas: This parcel is mostly located within the delineated boundary of the Wolf Mountain oil field. There are no oil and gas wells drilled on this parcel, but it is encumbered by oil and gas lease COC-39889. The nearest well is immediately off the parcel and is a dry hole with a show of gas. This parcel has a high oil and gas potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	H
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 063

General Geology: Surface mapped as Iles Formation in the southwest portion of the parcel, and Mancos in the northeast (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-39889, but has no wells drilled on it. It is on the west flank of a large Tertiary intrusive. This parcel is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 064

General Geology: Surface mapped as Lewis Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: The underlying coal bearing Williams Fork Formation is projected to be less than 2,000 feet deep at this location. Located approximately 1 mile to the east is the inactive Hammond Mine, which mined a 4.5-foot coal bed from the Middle Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. No wells have been drilled on this parcel. This parcel is not near any producing wells or fields and is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 065

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. It is not in close proximity to a producing oil and gas field, but does have several dry holes drilled within two miles of it. This parcel is low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 066

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-39889, but has no wells have been drilled on it. It is not in close proximity to a producing oil and gas field, but does have several dry holes drilled within two miles of it. This parcel is low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 067

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Parcel is in Tow Creek area of geothermal potential (Miller, 1975). Considering this, the parcel has moderate potential for geothermal energy, but data is insufficient.

Oil & Gas: This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. It is not in close proximity to a producing oil and gas field, but does have several dry holes drilled within one mile of it. This parcel is low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	A

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 068

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. It is not in close proximity to a producing oil and gas field, but does have several dry holes drilled within one mile of it. This parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 069

General Geology: Surface mapped as Iles Formation in the southern and western portion of the parcel, with Mancos in the northern and eastern portion (Miller, 1975). Along the northwestern and southern boundaries of the parcel are narrow outcrops of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 1 mile to the south is the inactive Monger Mine, which mined 6-foot coal beds from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. It is not in close proximity to a producing oil and gas field, but does have several dry holes drilled within a few miles to the north and east. The Slippery Sides one well oil field is 2 miles to the south. This parcel is low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 070

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Along the southern boundary of the parcel is an outcrop of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Parcel is in Tow Creek area of geothermal potential (Miller, 1975). Considering this, the parcel has moderate potential for geothermal energy, but data is insufficient.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. At lease four dry holes have been drilled in close proximity. No wells have been drilled on this parcel. This parcel is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	A

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 071

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Near the southwest corner of the parcel is a northwest-southeast trending, high-angle fault, with the down-dropped side to the northeast.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The parcel is located approximately 1.5 mile north of the Tow Creek oil field and is on the projection of the same anticlinal structure as the field. The Slippery Side oil field is also about one mile to the south. Although it appears to be on trend with the Tow Creek anticlinal axis, the fold is mapped short of this parcel and an igneous dike intervenes between any projected axis and this parcel. This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. This parcel is low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 073

General Geology: Surface mapped as Lance Formation in the eastern portion of the parcel, with Lewis in the western portion (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Williams Fork Formation is projected to be less than 2,000 feet deep at this location (Johnson and others, 2000). Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-57089, but no wells have been drilled on it. There is a dry hole amount 0.5 mile to the west of the parcel. KLT Energy has a pilot fee CBM project about 2 miles to the west and the two well Pelt gas field is about 1.8 mile to the northwest. Production from this field is conventional gas from the Niobrara. This parcel has low potential based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 076

General Geology: Surface mapped as Lewis Formation (Miller, 1975). Passing through the parcel is a major north-south trending synclinal structure.

Leasable Minerals: Coal: The underlying coal bearing Williams Fork Formation (Middle Coal Group) is projected to be less than 2,000 feet deep at this location. Located approximately 1 mile to the northeast is an inactive stip mine, which mined coal from the Middle Coal Group. Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is located near a synclinal axis east of the Tow Creek anticline. It is approximately 2.8 miles east of the Grassy Creek oil field. This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 078

General Geology: Surface mapped as Quaternary unconsolidated colluvium (Miller, 1975), probably washed down from the Precambrian basement rocks of the Park Range. Probably underlying Quaternary deposits in this area are the Precambrian basement rocks. No faults or folds noted.

Leasable Minerals: Coal: No potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. This parcel has no oil and gas potential.

Locatable Minerals: Located approximately 1.5 mile to the east of the parcel is the Fish Creek uranium occurrence. Although it is possible that the underlying Precambrian basement rocks could host a similar occurrence, or precious or base metal veins, there is no evidence of any such occurrence or previous mining activity in the area. The parcel therefore has low potential for locatable minerals, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 077

General Geology: Surface mapped as Iles Formation (Miller, 1975). Approximately 0.2 mile northeast of the parcel is a northwest-southeast trending, high-angle fault, with the down-dropped side to the northeast.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-56893, but has no wells drilled on it. It is located about 2 miles west of the Curtis oil field. Three wells have been drilled approximately 0.7 mile to the northeast of this parcel but they are dry holes. Directly north of the parcel at 1.1 mile, a well has been drilled with an initial production of 15 barrels of oil. The production zone is in the Niobrara near or on an intrusive sill. This location has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 076

General Geology: Surface mapped as Lewis Formation (Miller, 1975). Passing through the parcel is a major north-south trending synclinal structure.

Leasable Minerals: Coal: The underlying coal bearing Williams Fork Formation (Middle Coal Group) is projected to be less than 2,000 feet deep at this location. Located approximately 1 mile to the northeast is an inactive stip mine, which mined coal from the Middle Coal Group. Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is located near a synclinal axis east of the Tow Creek anticline. It is approximately 2.8 miles east of the Grassy Creek oil field. This parcel is not encumbered by an oil and gas lease and no wells have been drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 081

General Geology: Surface mapped as Williams Fork Formation (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: The coal bearing Williams Fork Formation (Middle Coal Group) is exposed within the parcel. This parcel lies entirely within the boundary of Federal Coal Lease COC 081258, and within the permit area for Seneca Coal Company's II-W Mine to the north. The Wolf Creek and Sage Creek beds are known to exist within the parcel, and are estimated to contain a resource of 1.8 million tons of coal. A portion of this parcel is scheduled for mining in 2008. Considering the favorable geologic environment, proximity to a known active mine, and the existence of known resources, the parcel has high potential for coal, based on abundant direct and indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It is located 1.6 mile due west of the Sage Creek field. There are no wells drilled on this parcel and it is too far of the off of the Sage Creek anticline. It has a low potential for oil and gas development.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	H
Certainty	D

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 082

General Geology: Surface mapped as Iles Formation in the western portion of the parcel, and Mancos in the central and eastern portion (Miller, 1975). Approximately 0.5 mile to the south of the parcel is an east-west trending, high-angle fault, with the down-dropped side to the south.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: The eastern part of this parcel is located within the designated boundary of the Sage Creek field. One well has been drilled on the parcel and is a dry hole. Several other wells have been drilled near this parcel with shows of oil but are considered dry holes. This parcel is not currently leased and has a moderate potential for oil and gas development based on direct evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	C

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 084

General Geology: Surface mapped as Williams Fork Formation and Iles Formation (Miller, 1975). The parcel is situated between two north-south trending anticlinal structures, one approximately 1 mile east and the other 1 mile west.

Leasable Minerals: Coal: The coal bearing Williams Fork Formation (Middle Coal Group) and Iles Formation (Lower Coal Group) are exposed within the parcel. The northern half of this parcel lies within the boundary of Federal Coal Lease COC 0114093, and within the permit area for Seneca Coal Company's Yoast Mine to the north. The Wolf Creek bed is known to exist within the parcel, and is estimated to contain a resource of 4.3 million tons of coal. A portion of this parcel is scheduled for mining in 2007-8. Considering the favorable geologic environment, proximity to a known active mine, and the existence of known resources, the parcel has high potential for coal, based on abundant direct and indirect evidence.

Oil & Gas: This parcel is approximately 1 mile northeast of the Sage Creek field. It is currently encumbered by oil and gas lease COC-0122676, but has no wells drilled on it. It is too far off the Sage Creek anticline and is considered as low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	H
Certainty	D

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 085

General Geology: Surface mapped as Iles Formation (Miller, 1975). The parcel is situated between two north-south trending anticlinal structures, one approximately 2.5 miles east and the other 0.5 mile west.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is approximately 0.5 mile northeast of the Sage Creek field. It is encumbered by oil and gas lease COC-59178 and has never been drilled. It is considered low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 087

General Geology: Surface mapped as Iles Formation (Miller, 1975). The parcel is situated between two north south trending anticlinal structures, one approximately 1 mile east and the other 1 mile west.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is located 1.5 mile due east of the Sage Creek field. It is encumbered by oil and gas lease COC-0122676 and has no wells drilled on it. A dry Niobrara well was drilled about 0.3 mile to the southwest of the parcel. This parcel has low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 088

General Geology: Surface mapped as Iles Formation (Miller, 1975). A major north-south trending anticlinal structure passes through the parcel.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 1 mile to the southeast is the inactive Kaspar Mine, which mined a 5-foot bed from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: The parcel is located approximately 3.8 miles northeast of the Fish Creek oil field and is on the same anticlinal structure as the field. There are no wells drilled on this parcel which is encumbered by oil and gas lease COC-57715. This parcel has a moderate potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 089

General Geology: Surface mapped as Iles Formation (Miller, 1975). Approximately 0.2 mile northeast of the parcel is a northwest-southeast trending, high-angle fault, with the down-dropped side to the northeast.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is located about 2.3 miles south of the Curtis field. It is not encumbered by an oil and gas lease and has not been drilled. This parcel is low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 090

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos or Dakota Formation, or possibly Jurassic rocks. Approximately 1 mile to the southeast is a projection of a northeast-southwest trending, high-angle fault, with the down-dropped side to the southeast.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease and it has no wells drilled on it. This parcel has low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on direct visual evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on direct visual evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 091

General Geology: Surface mapped as Iles Formation in the northeast portion of the parcel, and Mancos in the southwest (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is located about 2.3 miles northeast of the Meander field. It is encumbered by oil and gas lease COC-65994 but has no wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 093

General Geology: Surface mapped as Iles Formation in the northwest portion of the parcel, and Mancos in the southwest (Miller, 1975). In the southeast portion of the parcel is an east-west trending, high-angle fault, with the down-dropped side to the south.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It has no wells drilled on it. The parcel is located about 1.4 mile west of the Sage Creek field and has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 094

General Geology: Surface mapped as Iles Formation in the northern and central portion of the parcel, and Mancos in the southern portion (Miller, 1975). Projecting into the parcel from the east is an east-west trending, high-angle fault, with the down-dropped side to the south.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It has no wells drilled on it. The parcel is located about 2.3 miles southwest of the Sage Creek field and has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 095

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It has no wells drilled on it. The parcel is located west of and about 2.2 miles from the Sage Creek and Fish Creek fields and has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 096

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Approximately 0.5 mile east of the parcel is a north-south trending anticlinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not leased and has no wells drilled on it. However, several dry holes have been drilled within a mile to the east of this parcel. It is considered low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 097

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not leased and has no wells drilled on it. However, several dry holes have been drilled within a mile to the east of this parcel. It is considered low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 098

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Approximately 0.5 mile east of the parcel is a north-south trending anticlinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It has no wells drilled on it. Several dry holes have been drilled just east of this parcel. The parcel is located about 2.1 miles west of the Fish Creek field and has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 099

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is located about 0.3 miles southwest of the Sage Creek field. It is not encumbered by an oil and gas lease and has not wells drilled on it. Two dry holes have been drilled within 0.5 mile of this parcel. This parcel has low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 101

General Geology: Surface mapped as Williams Fork Formation and Iles Formation in the eastern and central portion of the parcel, with Mancos Shale in the western portion (Miller, 1975). Approximately 0.5 mile west of the parcel is a north-south trending anticlinal structure. Approximately 1 mile east is a northwest-southeast trending, high-angle fault, with the down-dropped side to the southwest.

Leasable Minerals: Coal: The coal bearing Williams Fork Formation (Middle Coal Group) and Iles Formation (Lower Coal Group) are exposed within the parcel. The eastern portion of this parcel lies within the boundary of previous coal lease, COC 037180, for which a resource estimate and feasibility study for a surface mining operation was completed. The Wolf Creek and Wadge beds of the Middle Coal Group are known to exist within the parcel, and are estimated to contain a resource of 17.6 million tons of coal. Considering the favorable geologic environment and the existence of known resources, the parcel has high potential for coal, based on abundant direct and indirect evidence.

Oil & Gas: A dry hole has been drilled less than a mile to the west of this parcel. It has oil shows but no production. This parcel is encumbered by oil and gas leases COC-7796, COC-59175, and COC-53902. There are no wells drilled on this parcel and it has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	H
Certainty	D

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 102

General Geology: Surface mapped as Williams Fork and Iles formations (Miller, 1975). The parcel is situated along a northwest-southeast structural trend composed of several high-angle faults, with the down-dropped sides all to the southwest.

Leasable Minerals: Coal: The coal bearing Williams Fork Formation (Middle Coal Group) and Iles Formation (Lower Coal Group) are exposed within the parcel. In the western portion of the parcel, the Middle Coal Group has been removed by the inactive Energy Strip Mine. Approximately 1 mile to the east is the inactive Middle Creek Mine, which mined from the Lower Coal Group. Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal in the Lower Coal Group, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It is approximately 1.5 mile north of the one well Trout Creek field. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 104

General Geology: Surface mapped as Williams Fork Formation, lying just above the outcrop of the Trout Creek Sandstone (Miller, 1975). The parcel lies along the projection of a northwest-southeast trending, high-angle faults, with the down-dropped side to the southwest.

Leasable Minerals: Coal: The coal bearing Williams Fork Formation (Middle Coal Group) is exposed within the parcel. Considering the favorable geologic environment, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64217. It is approximately 1.2 mile west of the one well Trout Creek field. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 104A

General Geology: Surface mapped as Iles Formation in the western portion of the parcel, with Mancos Shale in the eastern portion (Miller, 1975). The outcrop of the Tow Creek Sandstone is present within the parcel. The parcel is situated within a mapped graben structure bounded by up-lifted blocks between two northwest-southeast trending, high-angle faults.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64216. It is approximately 2.2 miles west of the Oak Creek oil field. Many of the wells within this field are dry holes. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 104B

General Geology: Surface mapped as Iles Formation in the northwestern portion of the parcel, with Mancos Shale in the southeastern portion (Miller, 1975). The outcrop of the Tow Creek Sandstone is present within the parcel. The parcel is situated within a mapped horst structure between two down-dropped blocks bounded by northwest-southeast trending, high-angle faults.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64216. It is approximately 2.2 miles west of the Oak Creek oil field. Many of the wells within this field are dry holes. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 104C

General Geology: Surface mapped as Iles Formation in the northwestern portion of the parcel, with Mancos Shale in the southeastern portion (Miller, 1975). The outcrop of the Tow Creek Sandstone is present within the parcel. The parcel is situated within a mapped horst structure between two down-dropped blocks bounded by northwest-southeast trending, high-angle faults.

Leasable Minerals: Coal: Only the lowest portion of the Iles Formation, below the Lower Coal Group beds, is exposed within the parcel. The parcel therefore has low potential for coal, based on indirect evidence.

Oil & Gas: This parcel is encumbered by oil and gas lease COC-64216. It is approximately 2.2 miles west of the Oak Creek oil field. Many of the wells within this field are dry holes. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 104D

General Geology: Surface mapped as Iles Formation (Miller, 1975). Approximately 0.5 mile to the southwest is a northwest-southeast trending, high-angle fault, with the down-dropped side to the southwest.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 1 mile to the northeast is the inactive Apex #2 Mine, which mined from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas. It is approximately 2.2 miles west of the Oak Creek oil field. Many of the wells within this field are dry holes. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 105

General Geology: Surface mapped as Browns Park Formation (Miller, 1975). Probably underlying Browns Park in this area is the Mancos Shale. Approximately 1 mile to the west is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on direct visual evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on direct visual evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 106

General Geology: Surface mapped as Mancos Shale, with Quaternary alluvium in the northeast portion of the parcel (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill aggregate resource to exist within the parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 107

General Geology: Surface mapped as Mancos Shale, with Tertiary volcanics in the southwest portion of the parcel (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 108

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 109

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 110

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 111

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 112

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 113

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The Pagoda gas field is approximately 2.5 miles to the northwest of this parcel. This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 114

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is not encumbered by an oil and gas lease. It does not have any wells drilled on it. It has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 115

General Geology: Surface mapped as Mancos Shale (Miller, 1975). A major northwest-southeast trending synclinal structure passes through the parcel. To the south lie numerous outcrops of Tertiary volcanics.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field and a few miles east of the Pinnacle oil field. The parcel is encumbered by oil and gas lease COC-61729, but has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 116

General Geology: Surface mapped as Iles Formation, with Mancos Shale in the far eastern and western portion of the parcel (Miller, 1975). A major north-south trending anticlinal structure passes through the parcel.

Leasable Minerals: Coal: The coal bearing Iles Formation (Lower Coal Group) is exposed within the parcel. Located approximately 1 mile to the north are the inactive Routt Curtis and Brazil Hastings mines, which mined from the Lower Coal Group (Turney and Murray-Williams, 1984). Considering the favorable geologic environment and proximity to known mines, the parcel has moderate potential for coal, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field and a few miles east of the Pinnacle oil field. The parcel is encumbered by oil and gas lease COC-61729, but has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 117

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Passing through the parcel is a northwest-southeast trending, high-angle fault, with the down-dropped side to the southwest. Southwest of the parcel is a northwest-southeast trending synclinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field and a few miles east of the Pinnacle oil field. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 118

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Approximately 0.5 mile northeast of the parcel is a northwest-southeast trending synclinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field and a few miles east of the Pinnacle oil field. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 118A

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field and a few miles east of the Pinnacle oil field. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 119

General Geology: Surface mapped as Mancos Shale (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field and a few miles east of the Pinnacle oil field. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 120

General Geology: Surface mapped as Mancos Shale in the northern portion of the parcel, with Browns Park in the southern portion (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: The nearest oil and gas field is nearly 5 miles to the west. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 121

General Geology: Surface mapped as Mancos Shale in the western portion of the parcel, with Browns Park in the eastern portion (Miller, 1975). Passing through the parcel is a north-south trending, high-angle fault, with the down-dropped side to the east.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 121A

General Geology: Surface mapped as Mancos Shale (Miller, 1975). A major northwest-southeast trending synclinal structure passes through the southwestern portion of the parcel. Also passing through the parcel are two narrow, northwest-southeast trending outcrops of Tertiary volcanics.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: This parcel is approximately 2 miles south of the Oak Creek oil field. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 122

General Geology: Surface mapped as Mancos Shale, with Browns Park Formation along the northern boundary of the parcel (Miller, 1975). Tertiary volcanics outcrop to the southwest, west, and north of the parcel. Passing through the parcel is a northwest-southeast trending, high-angle fault, with the down-dropped side to the northeast.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 123

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Along the northeast corner of the parcel is a northwest-southeast trending synclinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 124

General Geology: Surface mapped as Mancos Shale (Miller, 1975). Approximately 0.5 mile northeast of the parcel is a northwest-southeast trending synclinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 125

General Geology: Surface mapped as Mancos Shale, with Quaternary alluvium in the southeast portion of the parcel (Miller, 1975). Approximately 0.5 mile northeast of the parcel is a northwest-southeast trending synclinal structure.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas lease and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill aggregate resource to exist within the parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 126

General Geology: Surface mapped as Quaternary alluvium, with Mancos Shale in the southeast portion of the parcel (Miller, 1975). The parcel is situated between a northwest-southeast trending synclinal structure 0.5 mile to the southwest and a parallel anticlinal structure 0.5 mile to the northeast.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill aggregate resource to exist within the parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 128

General Geology: Surface mapped as Mancos Shale (Miller, 1975). A major northwest-southeast trending anticlinal structure passes through the parcel. Near the southeast corner of the parcel is a northeast-southwest trending, high-angle fault, with the down-dropped side to the northwest.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 129

General Geology: Surface mapped as Mancos Shale, with Quaternary alluvium in the northwest portion of the parcel (Miller, 1975). Along the northwest corner of the parcel is a northeast-southwest trending, high-angle fault, with the down-dropped side to the northwest.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill aggregate resource to exist within the parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 130

General Geology: Surface mapped as Quaternary alluvium in the northwest portion of the parcel, with Browns Park Formation in the southeast portion (Miller, 1975). Also in the southeast corner is an outcrop of Tertiary volcanics. No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Considering the favorable geologic environment, there is moderate potential for a valley fill aggregate resource to exist within the parcel, based on indirect evidence.

Overall Ranking:

Potential	M
Certainty	B

MINERAL POTENTIAL REPORT

EMERALD MOUNTAIN LAND EXCHANGE

ROUTT COUNTY, COLORADO

PARCEL NO. 131

General Geology: Surface mapped as Tertiary volcanics (Miller, 1975). No faults or folds noted.

Leasable Minerals: Coal: Low potential for coal within parcel, based on indirect evidence.

Oil & Gas: Several dry holes have been drilled in this area and this parcel is not close to any producing fields. The parcel is not encumbered by an oil and gas and has no wells drilled on it. This parcel has a low potential for oil and gas development based on indirect evidence.

Locatable Minerals: Low potential for locatable minerals within parcel, based on indirect evidence.

Mineral Materials: Low potential for mineral materials within parcel, based on indirect evidence.

Overall Ranking:

Potential	L
Certainty	B

R89W R88W R87W R86W R85W R84W R83W

T12N T11N T10N T9N T8N T7N T6N T5N T4N T3N T2N T1N

N

Hayden Steamboat Springs Oak Creek Yampa

40 131 134

FIGURE 1
EMERALD MOUNTAIN LAND EXCHANGE
MINERAL POTENTIAL REPORT
STUDY AREA AND PARCEL LOCATION

BLM Parcels w/ Interested Participants (08/26/03)

Surface Management Status

- BLM
- Division of Wildlife
- Private
- State Land Board
- State Park
- State Rec Area
- US Forest Service

0 2 4 6 Miles

R89W R88W R87W R86W R85W R84W R83W

T12N T11N T10N T9N T8N T7N T6N T5N T4N T3N T2N T1N

Hayden Steamboat Springs Oak Creek Yampa

40 131 134

0 2 4 6 Miles

FIGURE 2
EMERALD MOUNTAIN LAND EXCHANGE
MINERAL POTENTIAL REPORT
GENERAL GEOLOGY

BLM Parcels w/ Interested Participants (08/26/03)

General Geology
- Browns Park Formation
- Wasatch Formation
- Fort Union Formation
- Lance Formation
- Lewis Formation
- Iles Formation
- Chinle Formation
- Red Peak Formation
- Jurassic Sediments
- Triassic / Permian Sediments
- Minturn Formation
- Williams Fork Formation
- Tertiary Volcanics
- Dakota Formation
- Mancos Shale
- Basement Rocks
- Quaternary Deposits

FIGURE 3
GENERAL STRATIGRAPHIC COLUMN

EON	ERA	PERIOD	EPOCH	FORMATION		DESCRIPTION
PHANEROZOIC	CENOZOIC	QUATERNARY	Holocene Pleistocene	Surficial Deposits		Mud, silt, sand, gravel, and rock debris.
		TERTIARY	Pliocene	Igneous Rocks		Intrusive dikes, plugs, and sills of andesite, dacite, and latite; extrusive basalt flows and breccias, andesite cinder cones, and scorias.
			Miocene	Browns Park Formation		Light-gray to light-brown, mostly cross-bedded locally tuffaceous sandstone, conglomerate, claystone, and white volcanic ash.
			Eocene	Wasatch Formation		Varicolored claystone, mudstone, and siltstone; brown to gray lenticular sandstone; lesser conglomeratic sandstone and conglomerate; sparse carbonaceous shale.
			Paleocene	Fort Union Formation		Gray to brown sandstone, varicolored claystone and shale, carbonaceous shale with a few thin coal beds; lesser siltstone, mudstone, and conglomerate.
	MESOZOIC	CRETACEOUS	Upper	Lance Formation		Gray shale, light-brown sandstone and coal.
				Lewis Shale		Dark-gray homogeneous marine shale.
				Mesaverde Group	Williams Fork Formation	Light-brown to white sandstone, gray shale, and coal.
					Iles Formation	Massive beds of light-brown to white sandstone and interbedded gray shale and coal.
				Mancos Shale	Transition Zone	Interbedded thick to thin-bedded sandstone units separated by silty and sandy shales.
					Upper Mancos	Dark gray, soft, non-calcareous shale.
					Morapos Sandstone	Light gray to tan, fine-grained sandstone units separated by shale and siltstone.
					Lower Mancos	Dark gray, soft, non-calcareous shale with local sandstone and siltstone interbeds.
				Niobrara Formation		Dark gray-brown, organic-rich, calcareous shale with local limestone interbeds.
				Carlile Shale		Dark gray, soft, non-calcareous shale.
				Frontier Sandstone		Sandy limestone to calcareous sandstone.
				Mowry Shale		Thin-bedded, black, siliceous to carbonaceous shale.
			Lower	Dakota Sandstone		Conglomerate to fined-grained, carbonaceous sandstone.
		JURASSIC	Upper	Morrison Formation		Variegated red and green shale with occasional interbeds of limestone and sandstone.
			Middle	Entrada Sandstone		Massive, fine-grained sandstone.
		TRIASSIC	Upper	Chinle Formation		Red to brown shale, mudstone, and fine-grained sandstone.
			Middle	Shinarump Formation		Medium to coarse-grained sandstone and conglomerate.
			Lower	Moenkopi Formation		Red to green sandy shale, siltstones, and sandstone.
	PALEOZOIC	PERMO-PENNSYLVANIAN		Maroon Formation		Arkosic redbeds, sands and shales.
PROTEROZOIC		PRECAMBRIAN		Basement Rocks		Granite, gneiss, and schist.

R89W R88W R87W R86W R85W R84W R83W

T12N T11N T10N T9N T8N T7N T6N T5N T4N T3N T2N T1N

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052 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071

40 Hayden 073 076 077 078 Steamboat Springs 089 090

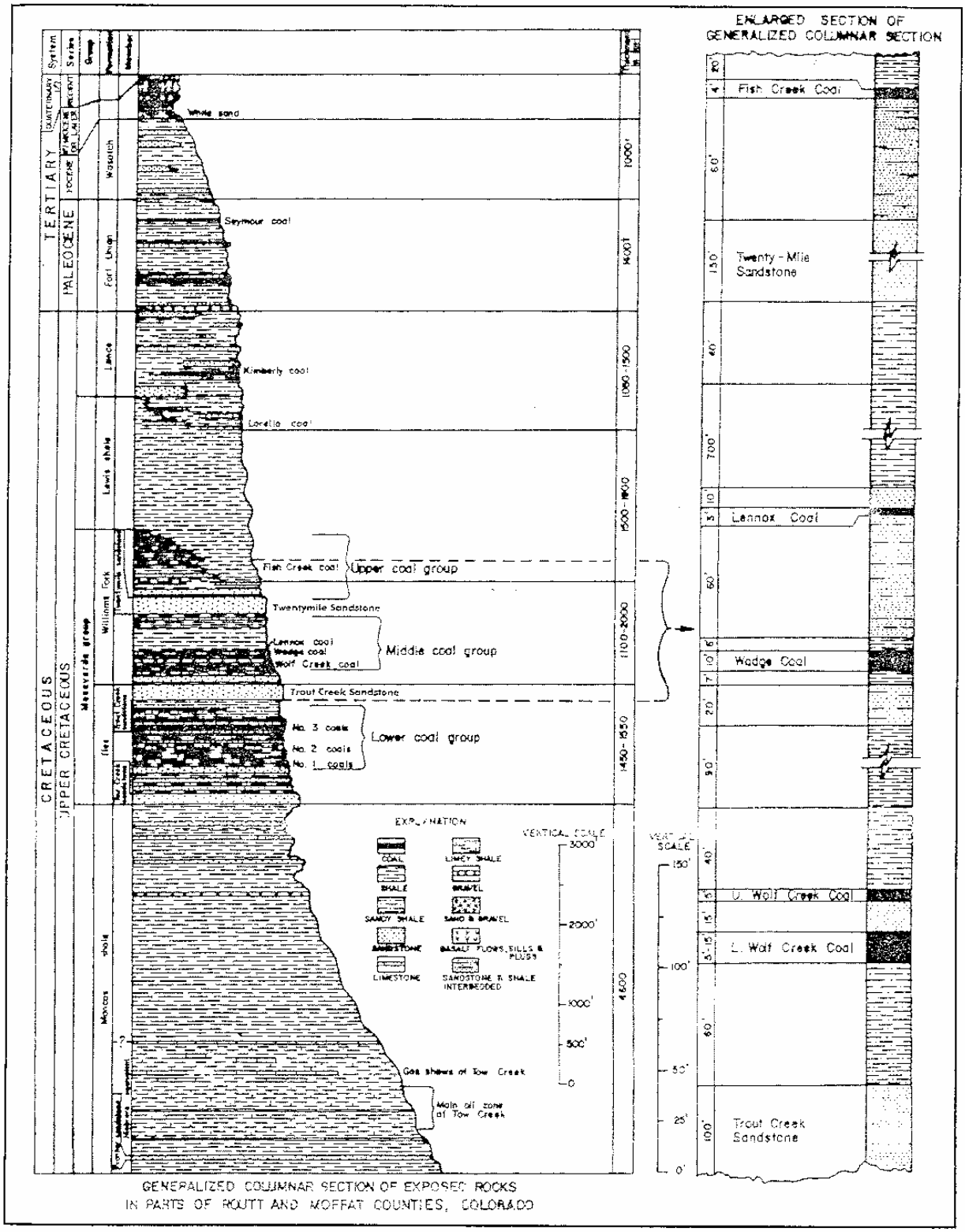
080 081 082 084 085 087 088 091 093 094 095 096 097 098 099 101 102 104 104A 104B 104C 104D 105 106 107 108 109 110 111 112 113 114 115 116 117 118 118a 119 120 121 121a 122 123 124 125 126 128 129 Yampa 130 131 134 Oak Creek 131

0 2 4 6 Miles

FIGURE 4
EMERALD MOUNTAIN LAND EXCHANGE
MINERAL POTENTIAL REPORT
YAMPA COAL FIELD AND COAL MINES

Coal Mines
- Coal Mine
- BLM Parcels w/ Interested Participants (08/26/03)

FIGURE 5
COAL STRATIGRAPHY



R89W R88W R87W R86W R85W R84W R83W

T12N T11N T10N T9N T8N T7N T6N T5N T4N T3N T2N T1N

N

FOCUS RANCH
CALIFORNIA PARK
BULL MOUNTAIN
RENFRO CREEK
WOLF MOUNTAIN
SLIPPERY SIDES
HIDDEN VALLEY
BEAR RIVER
TOW CREEK
GRASSY CREEK
SAGE CREEK NORTH
DRY CREEK
SAGE CREEK
DILL GULCH
PELT
MEANDER
INDIAN RUN
PAGODA
FISH CREEK
OAK CREEK
PINNACLE
CURTIS

Hayden
Steamboat Springs
Oak Creek
Yampa

40 131 134

001 002 003 004 005 006 008 009 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 038 039 040 041 042 043 044 045 046 047 048 049 050 051 052 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 073 076 077 078 080 081 082 084 085 087 088 089 090 091 093 094 095 096 097 098 099 101 102 104 104A 104B 104C 104D 105 106 107 108 109 110 111 112 113 114 115 116 117 118 118a 119 120 121 121a 122 123 124 125 126 128 129 130 131

FIGURE 6
EMERALD MOUNTAIN LAND EXCHANGE
MINERAL POTENTIAL REPORT
OIL AND GAS FIELDS AND WELLS

Oil & Gas Wells
BLM Parcels w/ Interested Participants (08/26/03)
Oil and Gas Fields
Tertiary
Upper Cretaceous
Lower Cretaceous
Triassic

0 2 4 6 Miles